

Switching

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<https://luizsantos.github.io/>



Switching

Modelo TCP/IP

Aplicação

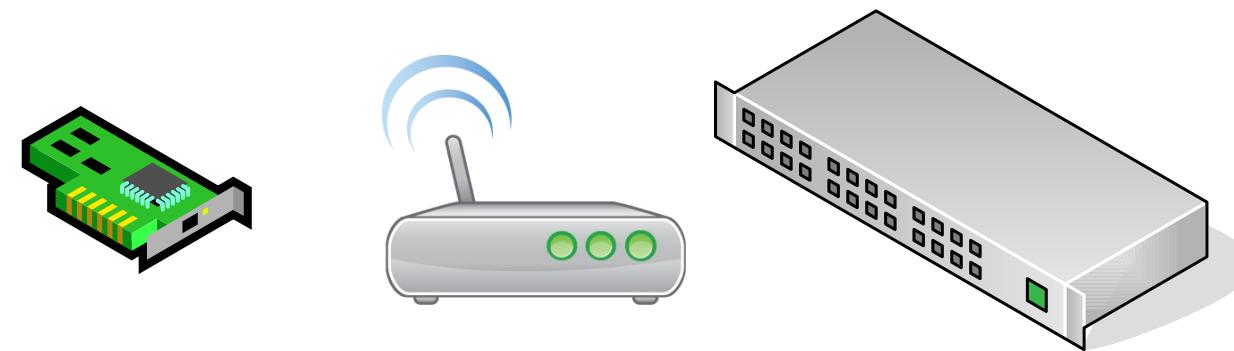
Transporte

Inter-rede

Enlace

Física

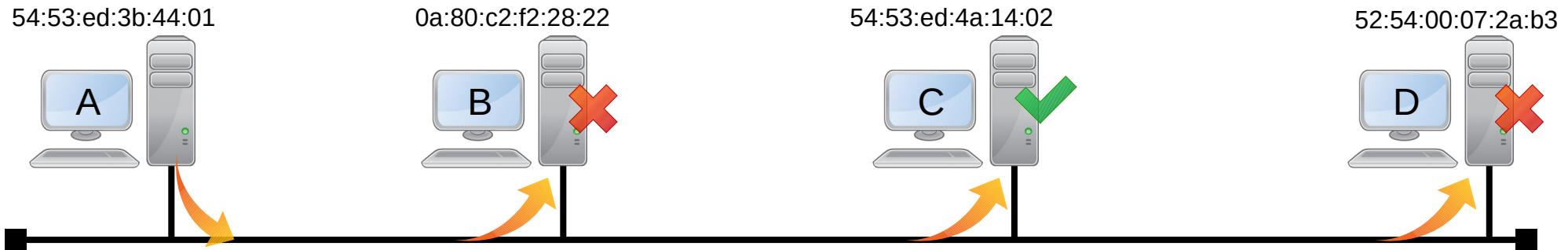
- Detecção de erros;
- Controle de acesso ao meio;
- Endereçamento físico;
- Impedir que *hosts* mais rápidos inundem de informações *hosts* mais lentos.



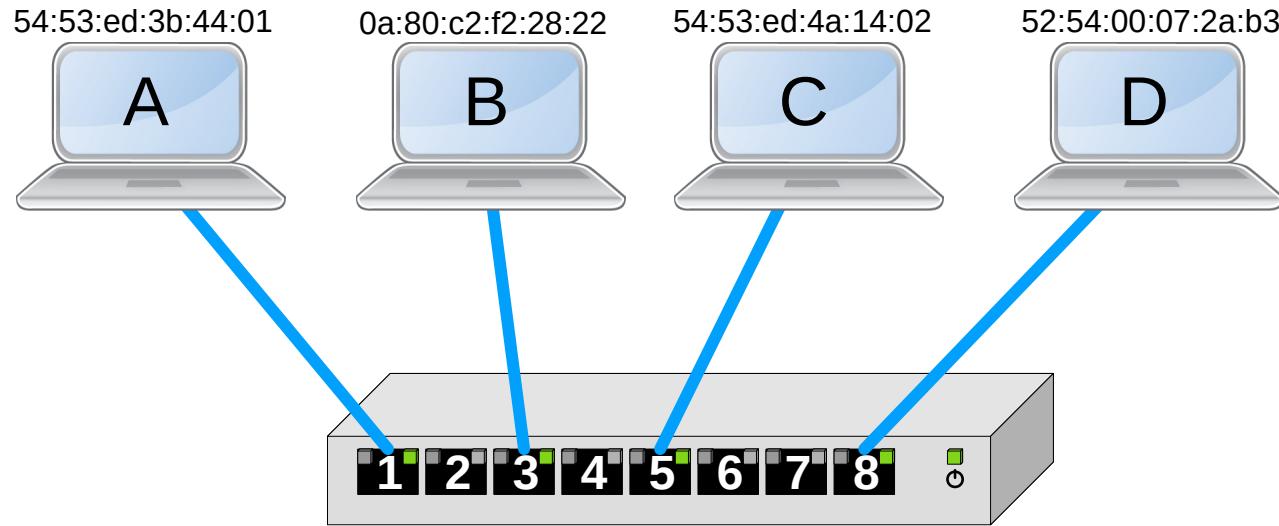
Switching

- A técnica de *Switching* é uma melhoria aplicada em redes Ethernet.
- Todavia redes Ethernet não trabalhavam originalmente com a ideia de comutação na Camada de Enlace, tal como é utilizada em switches.

Preamble+SFD <u>10101010..10101011</u>	Destination Address 54:53:ed:4a:14:02	Source Address 54:53:ed:3b:44:01	Type 0x0800	// Data e padding Olá	Checksum 0xaf90
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Switching



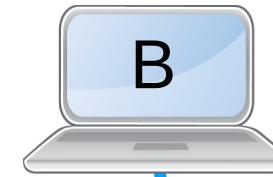
Switching

Quero falar
com D

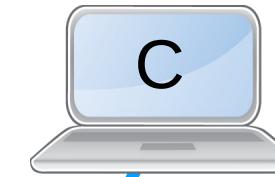
54...d:3b:44:01



0a:80:c2:f2:28:22



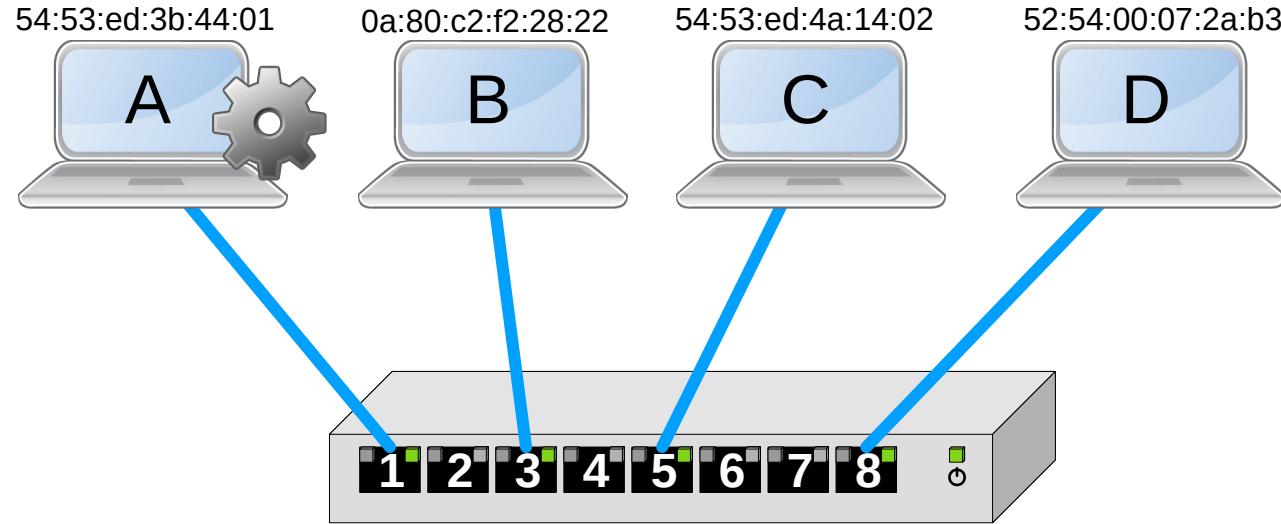
54:53:ed:4a:14:02



52:54:00:07:2a:b3

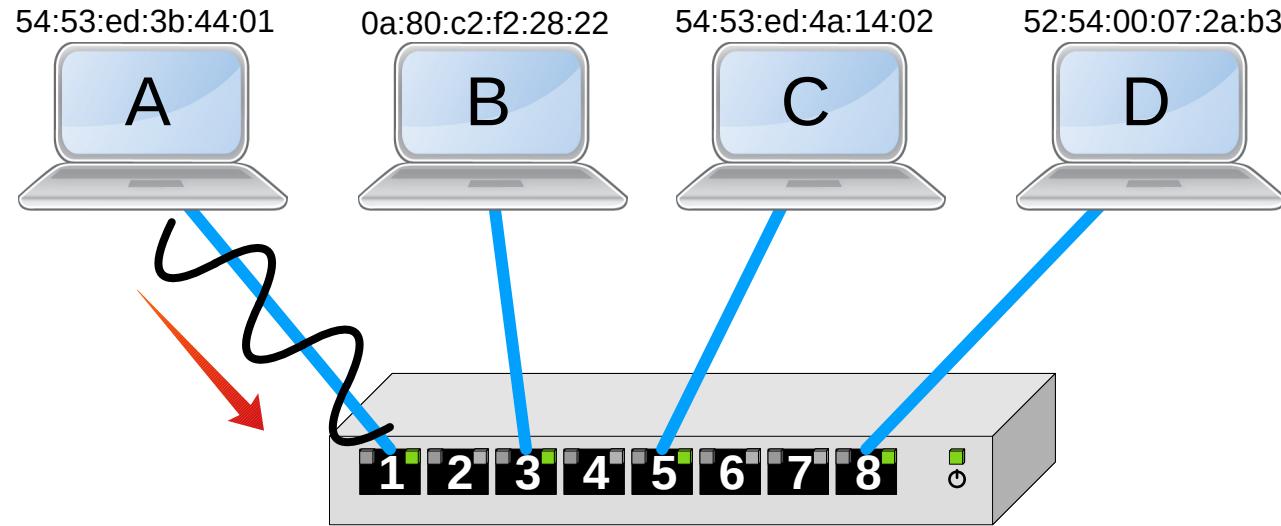


Switching



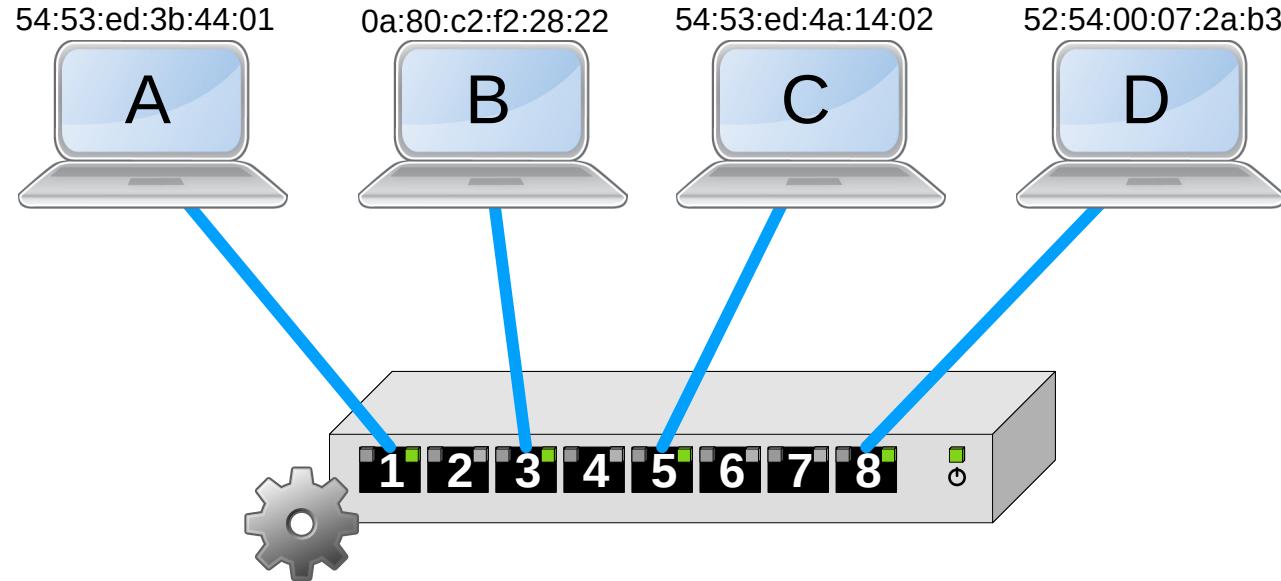
Preamble+SFD 10101010..10101011	Destination Address 52:54:00:07:2a:b3	Source Address 54:53:ed:3b:44:01	Type 0x0800	// Data e padding Olá //	Checksum 0xaf81
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Switching

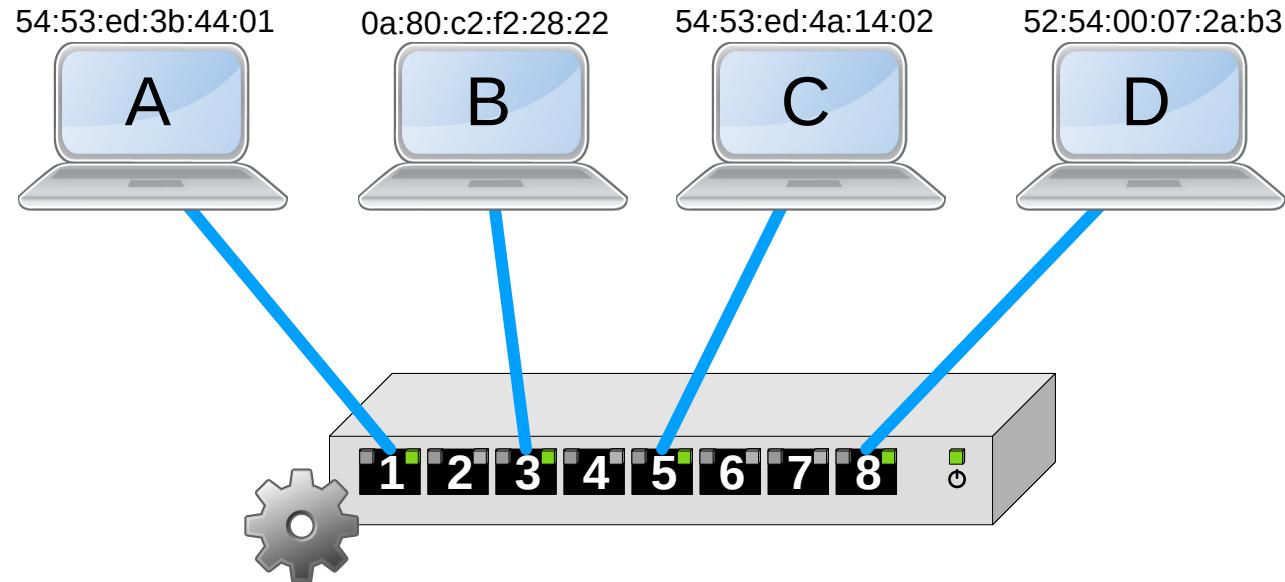


Preamble+SFD 10101010..10101011	Destination Address 52:54:00:07:2a:b3	Source Address 54:53:ed:3b:44:01	Type 0x0800	// Data e padding Olá //	Checksum 0xaf81
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Switching



Switching

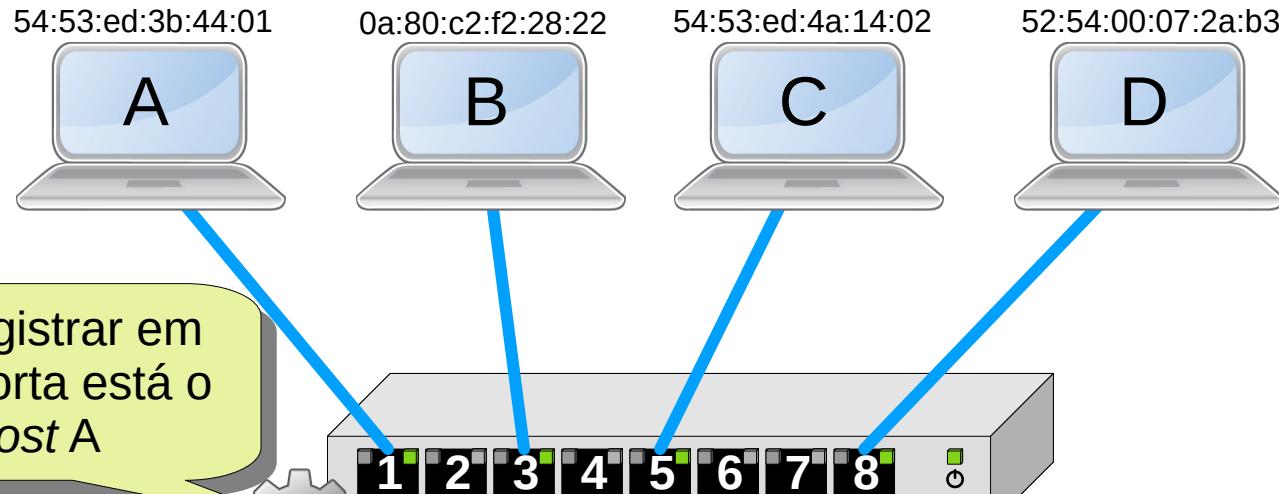


Porta	Hosts
1	
2	
3	
4	
5	
6	
7	
8	

Preamble+SFD 10101010..10101011	Destination Address 52:54:00:07:2a:b3	Source Address 54:53:ed:3b:44:01	Type 0x0800	Data e padding Olá	Checksum 0xaf81
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Switching

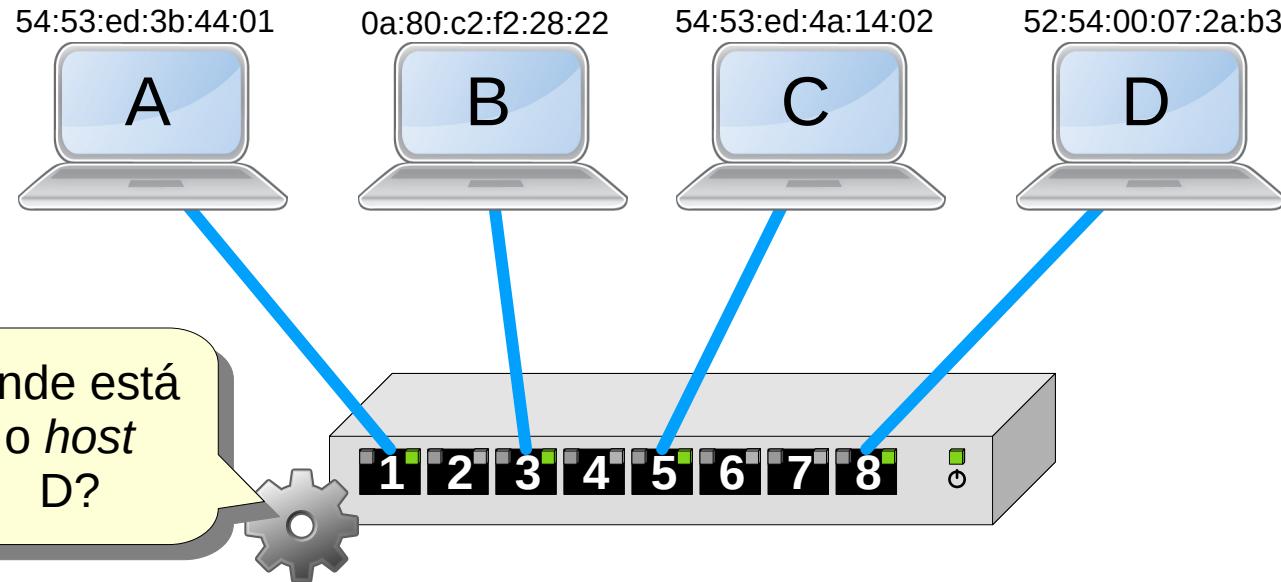


Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	
5	
6	
7	
8	

Preamble+SFD 10101010..10101011	Destination Address 52:54:00:07:2a:b3	Source Address 54:53:ed:3b:44:01	Type 0x0800	Data e padding Olá	Checksum 0xaf81
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Switching



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	
5	
6	
7	
8	

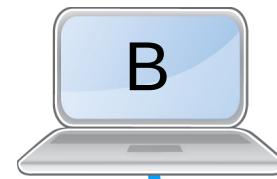


Switching

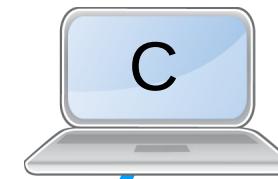
54:53:ed:3b:44:01



0a:80:c2:f2:28:22



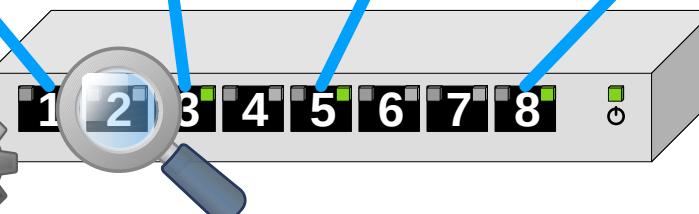
54:53:ed:4a:14:02



52:54:00:07:2a:b3



Onde está
o host
D?



Porta	Hosts
1	54:53:ed:3b:44:01
2	54:53:ed:3b:44:01 ?
3	
4	
5	
6	
7	
8	

Preamble+SFD
10101010..10101011

Destination Address
52:54:00:07:2a:b3

Source Address
54:53:ed:3b:44:01

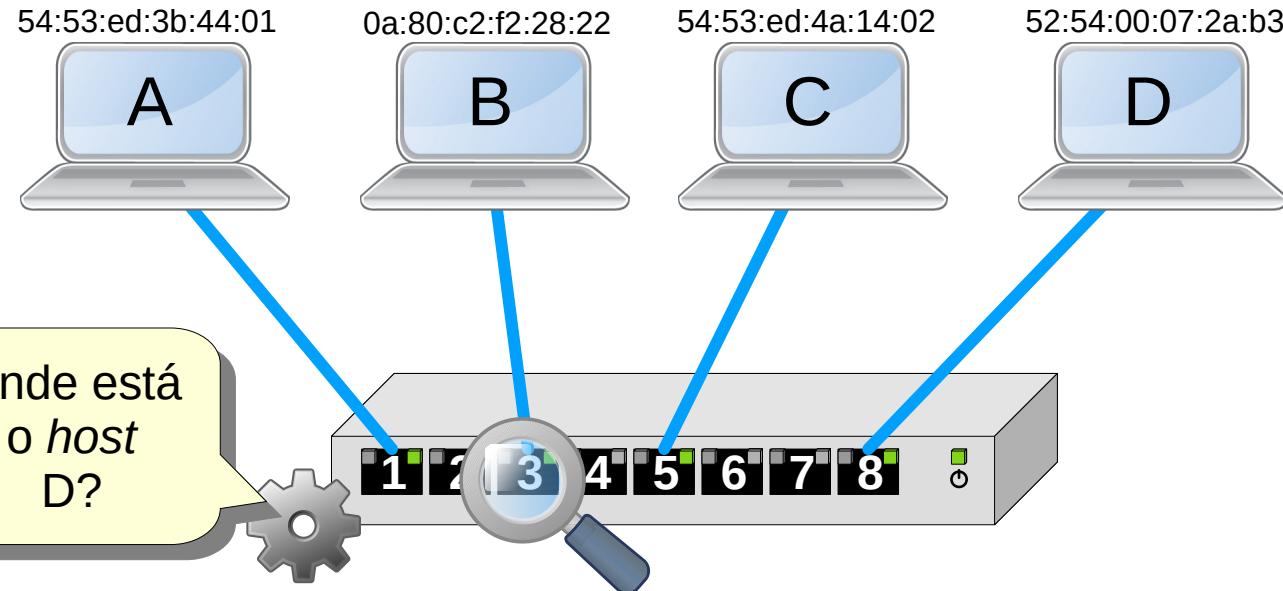
Type
0x0800

Data e padding
Olá //

Checksum
0xaf81

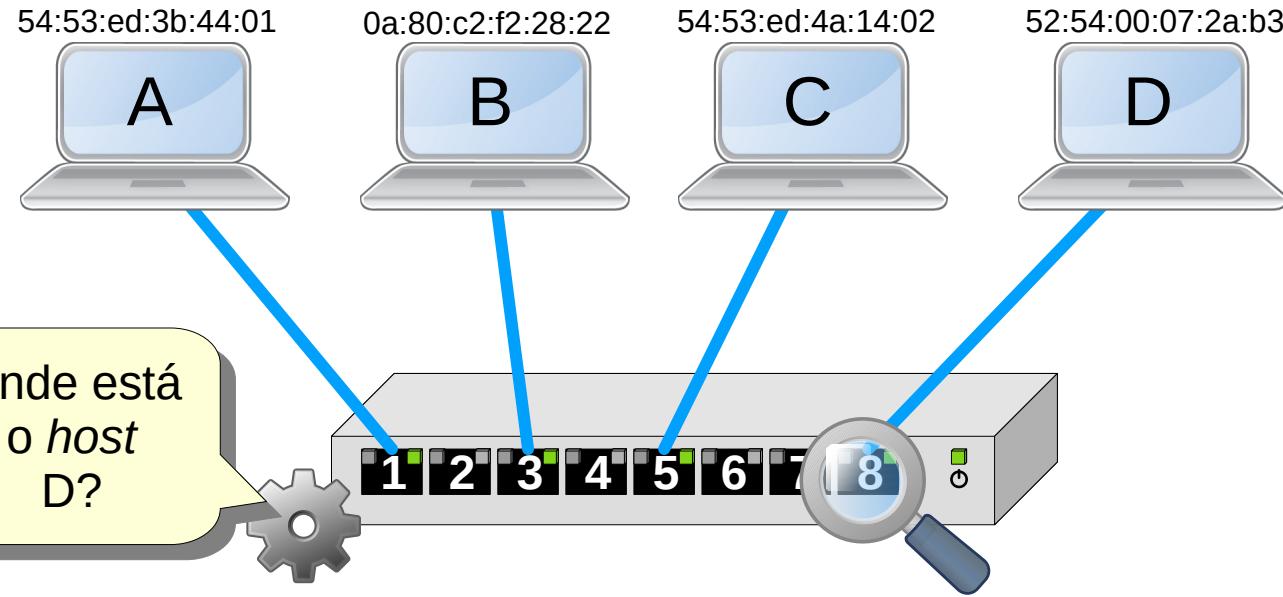


Switching



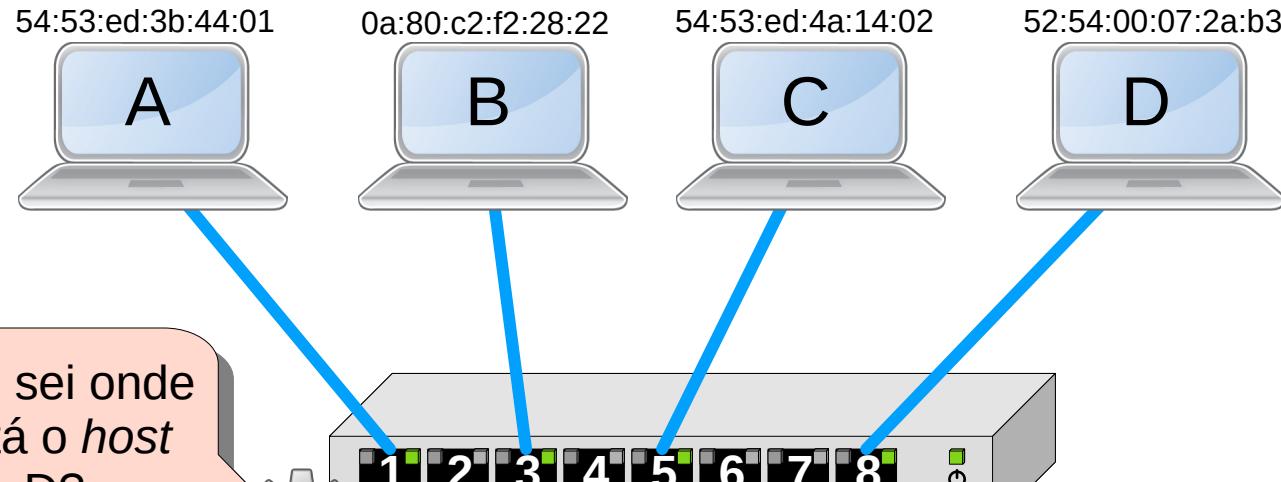
Preamble+SFD <u>10101010..10101011</u>	Destination Address 52:54:00:07:2a:b3	Source Address 54:53:ed:3b:44:01	Type 0x0800	Data e padding Olá	Checksum 0xaf81
				//	

Switching



Preamble+SFD <u>10101010..10101011</u>	Destination Address 52:54:00:07:2a:b3	Source Address 54:53:ed:3b:44:01	Type 0x0800	Data e padding Olá	Checksum 0xaf81
			//	//	

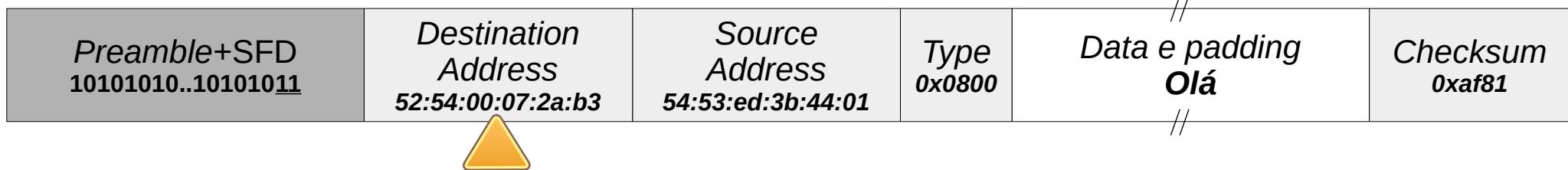
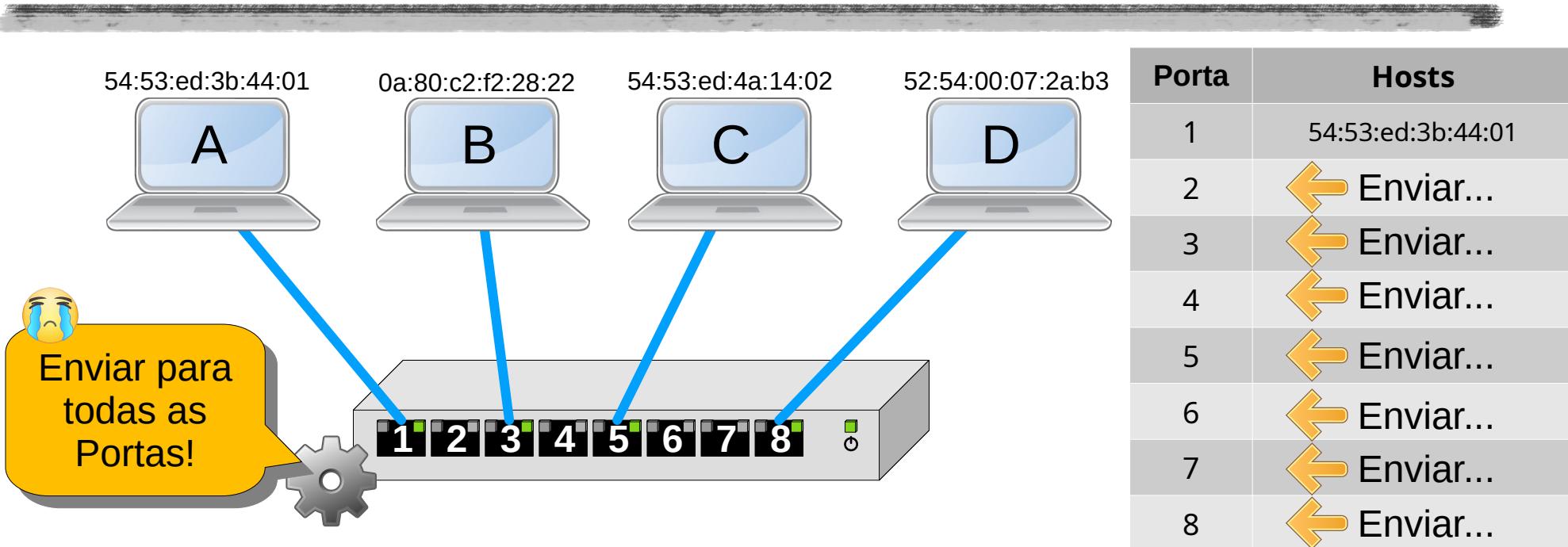
Switching



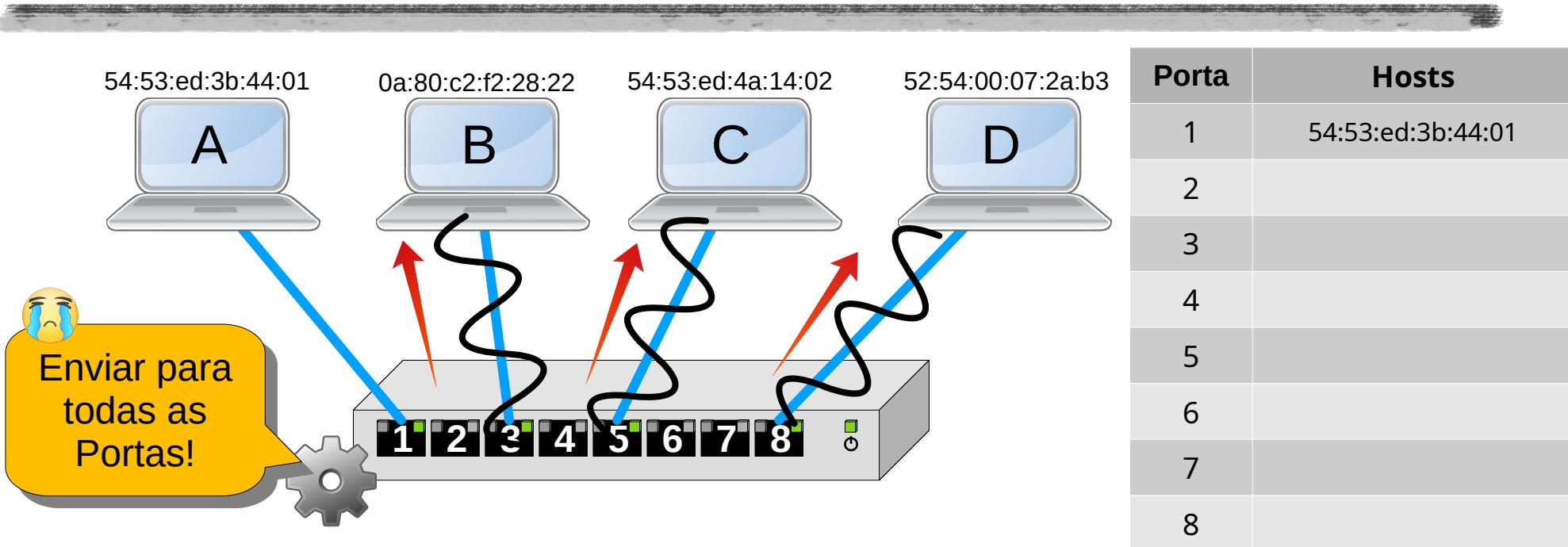
Porta	Hosts
1	54:53:ed:3b:44:01
2	?
3	?
4	?
5	?
6	?
7	?
8	?



Switching

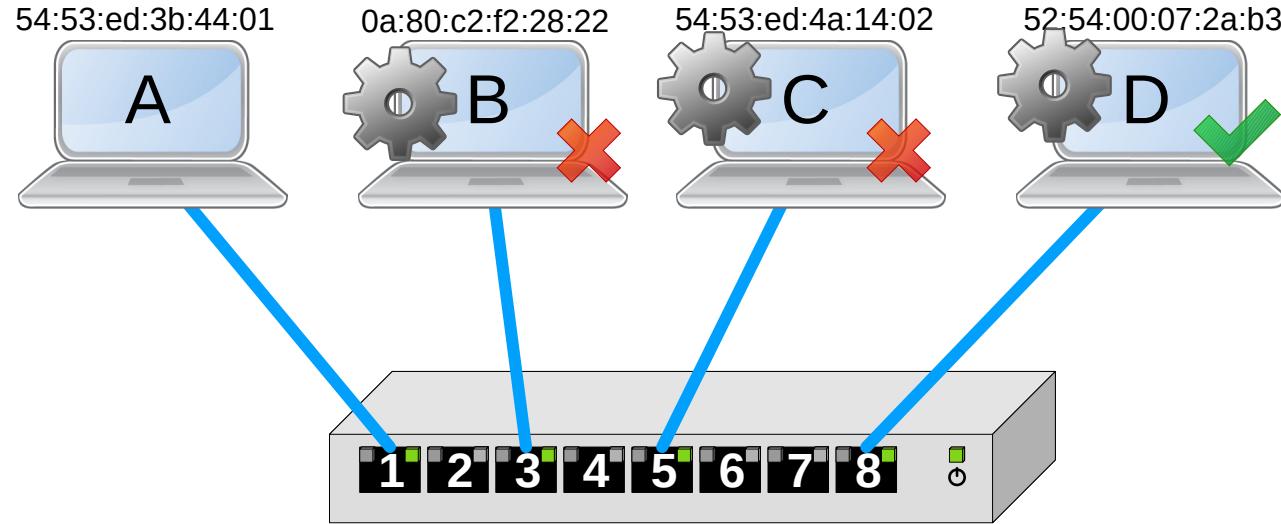


Switching



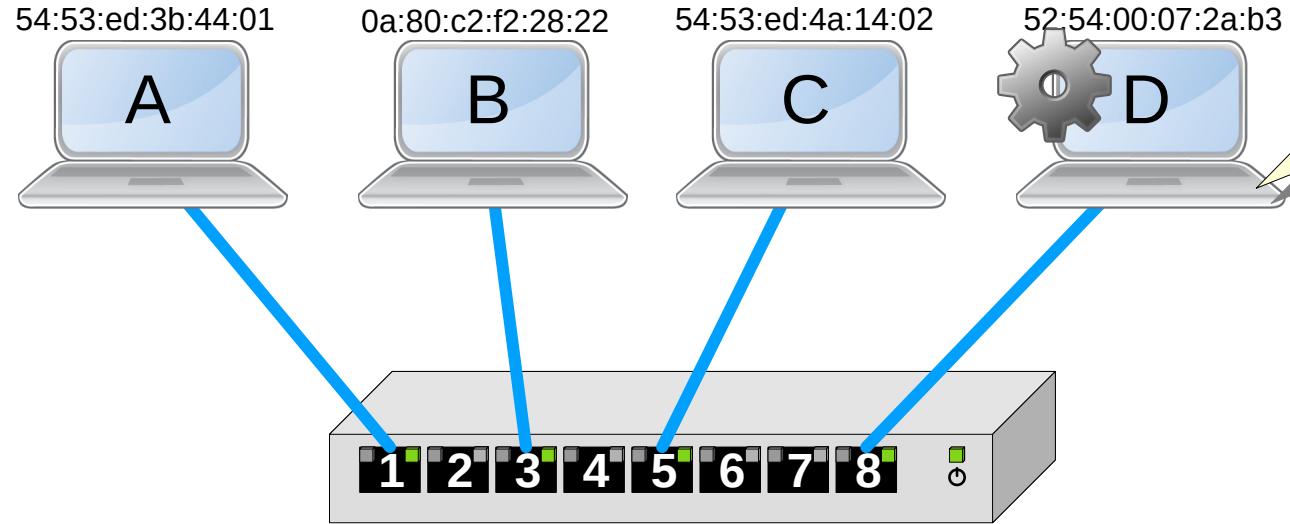
Preamble+SFD 10101010..101010 <u>11</u>	Destination Address 52:54:00:07:2a:b3	Source Address 54:53:ed:3b:44:01	Type 0x0800	// Data e padding Olá //	Checksum 0xaf81
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Switching



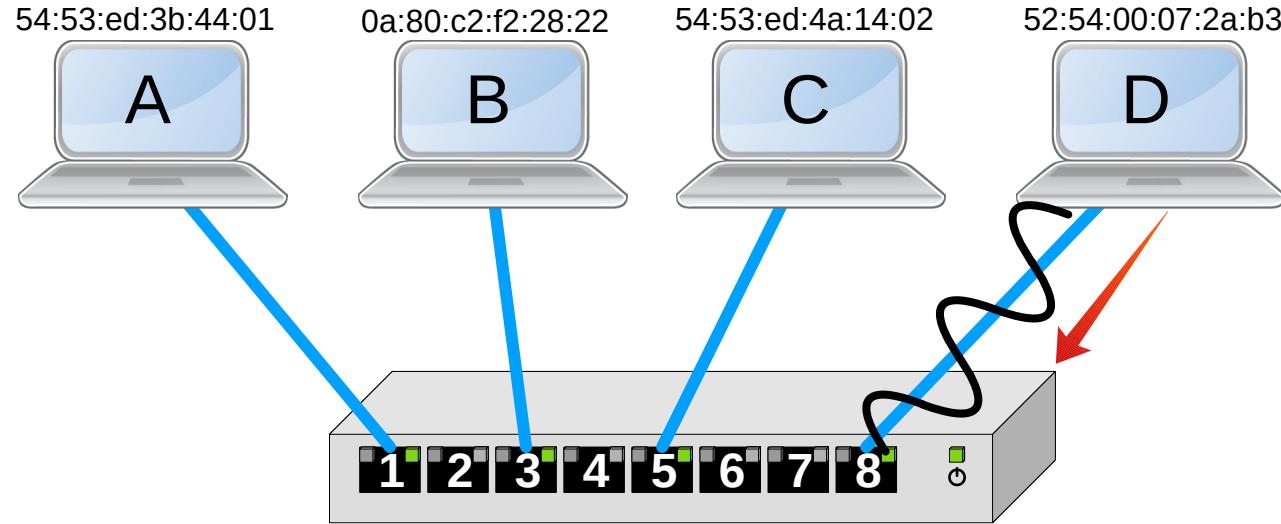
Preamble+SFD 10101010..10101011	Destination Address 52:54:00:07:2a:b3	Source Address 54:53:ed:3b:44:01	Type 0x0800	// Data e padding Olá //	Checksum 0xaf81
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Switching



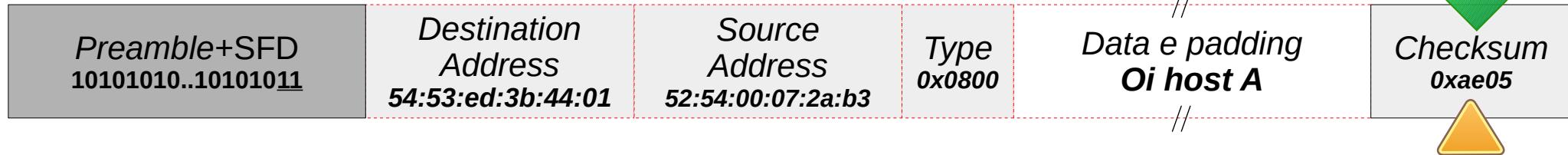
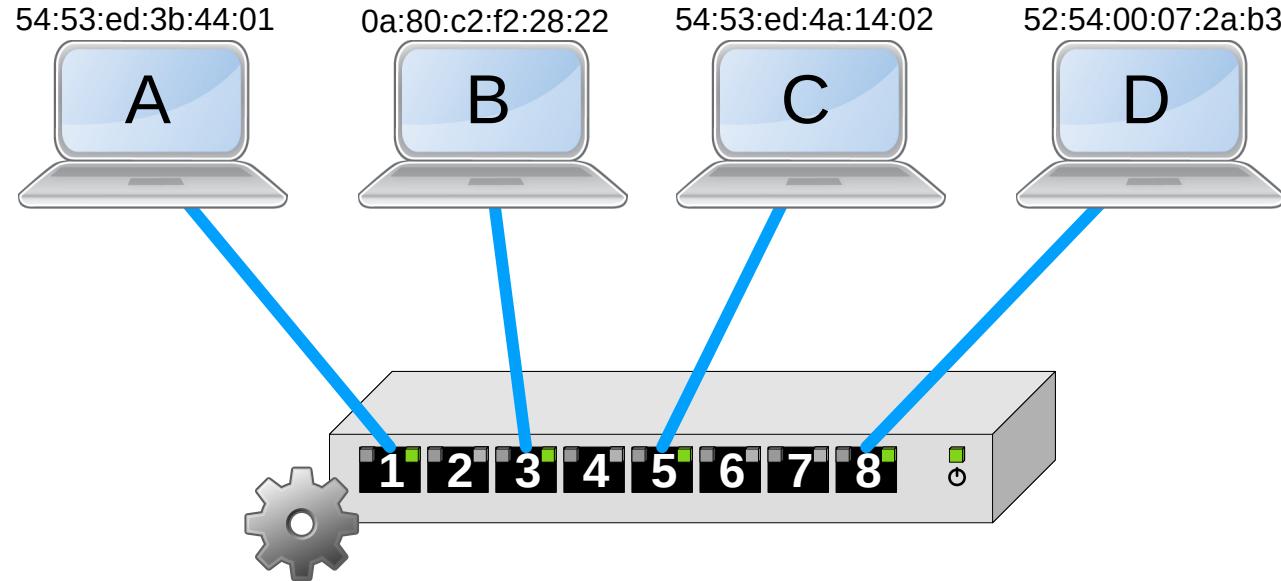
Preamble+SFD 10101010..10101011	Destination Address 54:53:ed:3b:44:01	Source Address 52:54:00:07:2a:b3	Type 0x0800	// Data e padding Oi host A //	Checksum 0xae05
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Switching

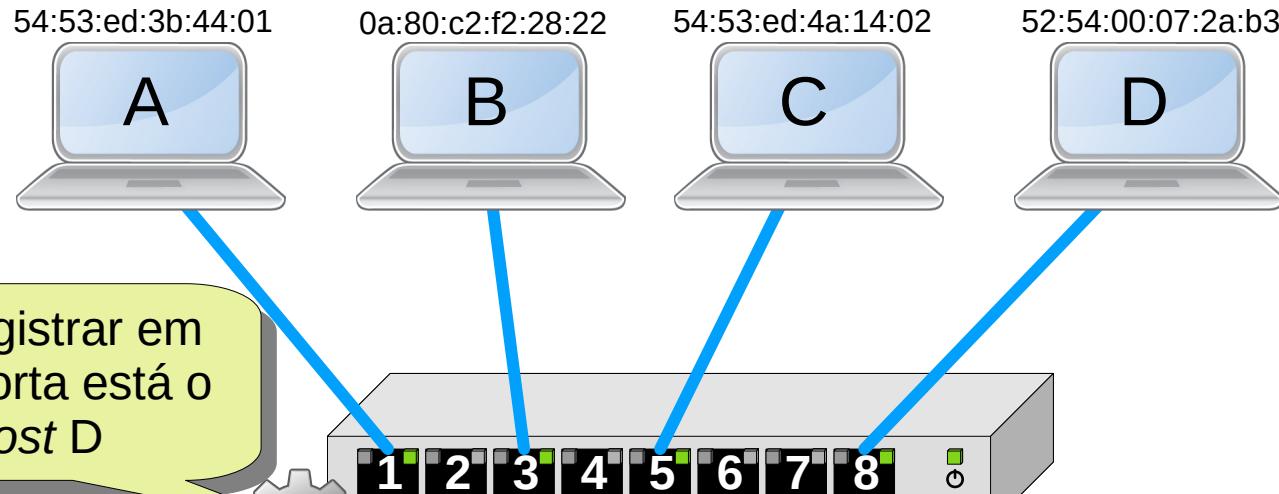


Preamble+SFD 10101010..10101011	Destination Address 54:53:ed:3b:44:01	Source Address 52:54:00:07:2a:b3	Type 0x0800	// Data e padding Oi host A //	Checksum 0xae05
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Switching



Switching

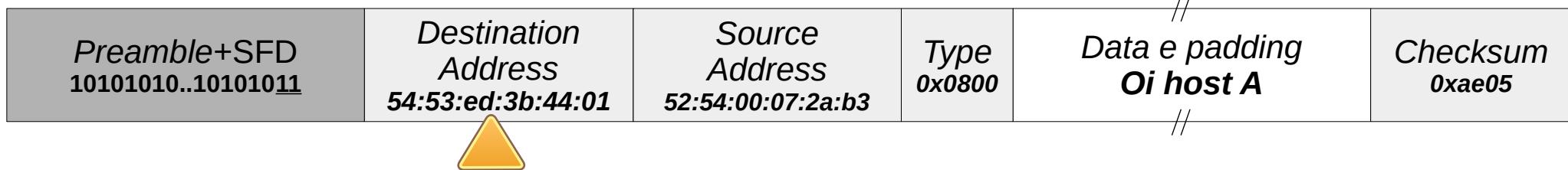
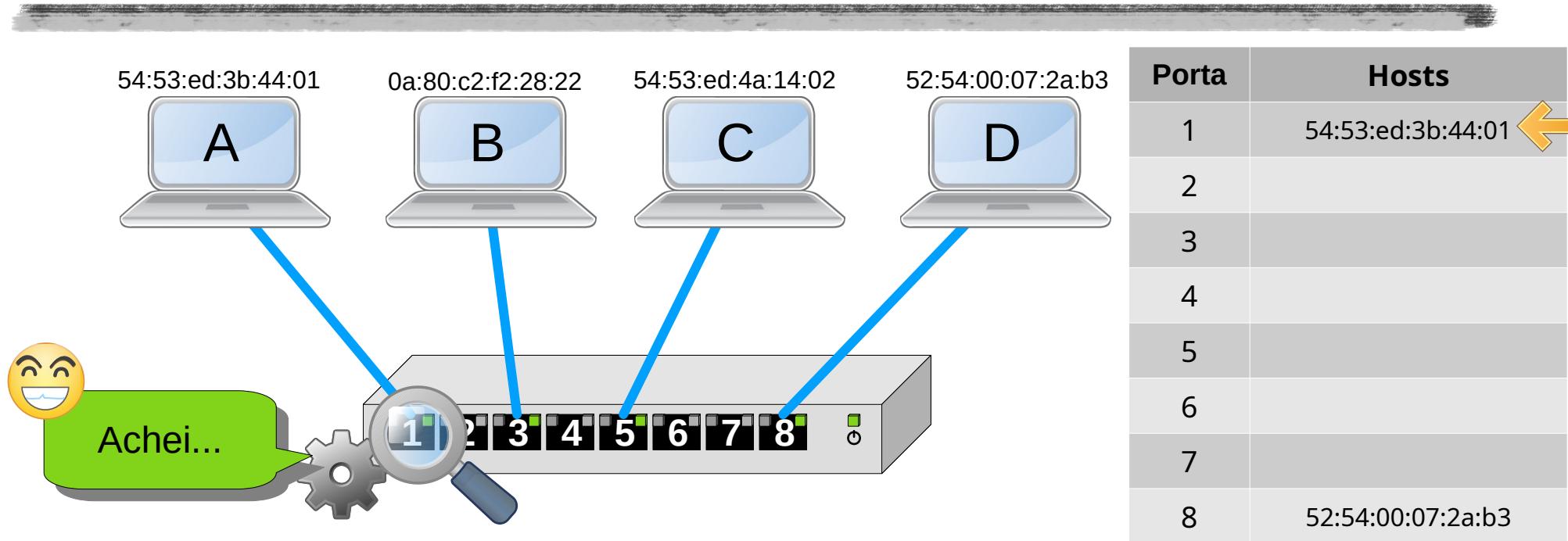


Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	
5	
6	
7	
8	52:54:00:07:2a:b3

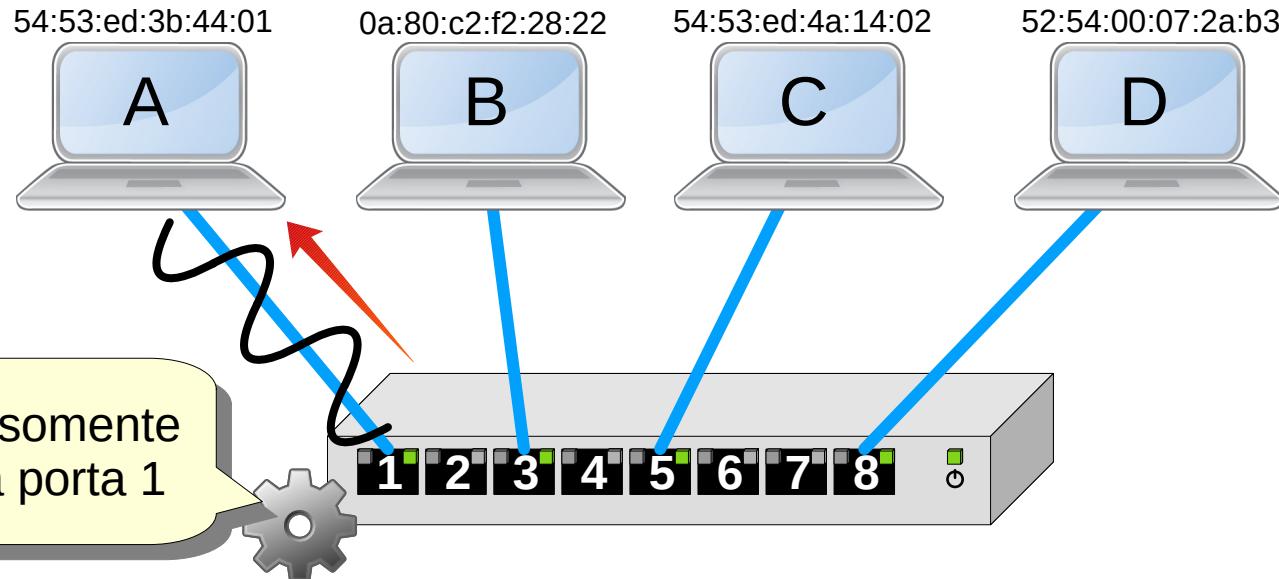
Preamble+SFD 10101010..101010 <u>11</u>	Destination Address 54:53:ed:3b:44:01	Source Address 52:54:00:07:2a:b3	Type 0x0800	Data e padding Oi host A	Checksum 0xae05
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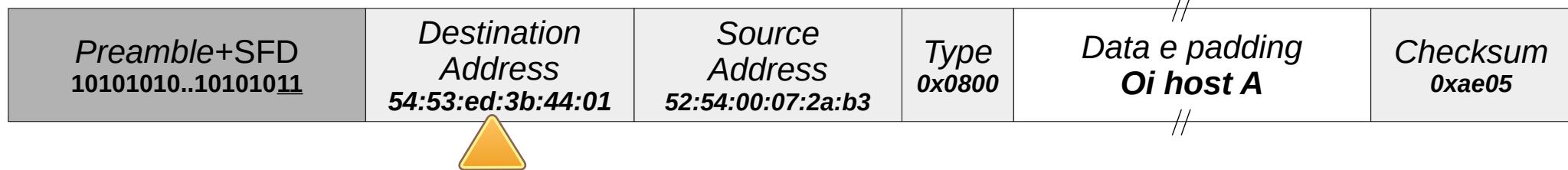
Switching



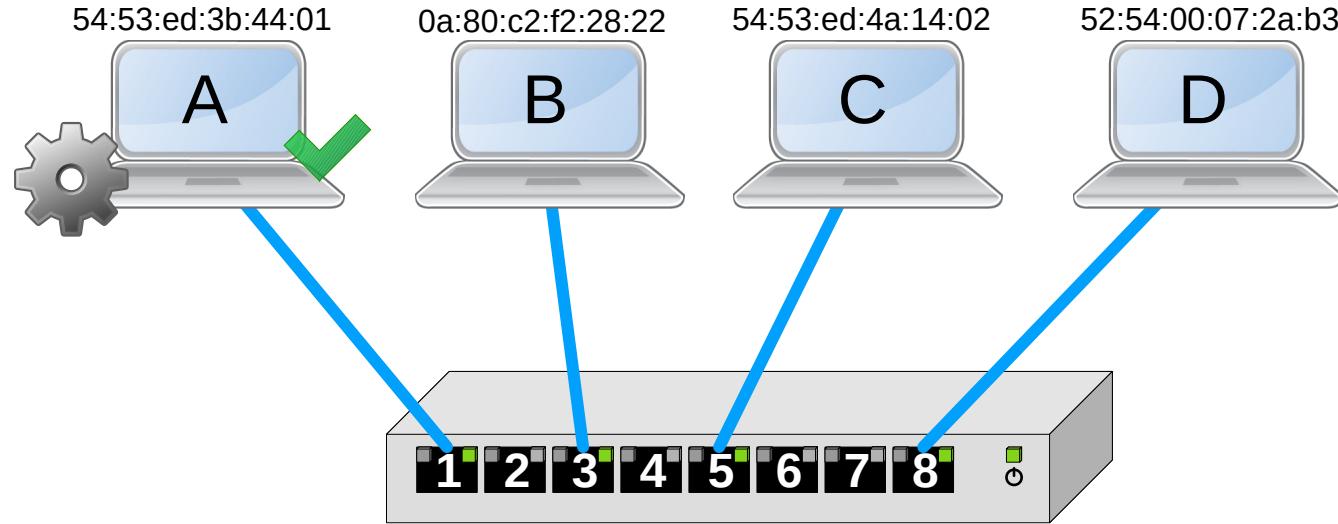
Switching



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	
5	
6	
7	
8	52:54:00:07:2a:b3

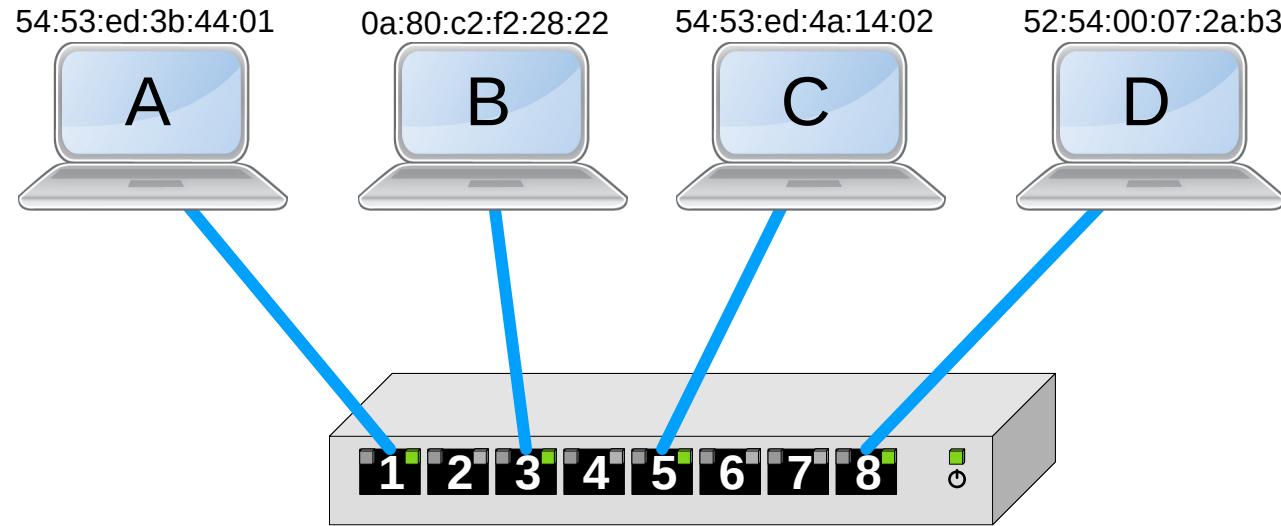


Switching



Preamble+SFD 10101010..10101011	Destination Address 54:53:ed:3b:44:01	Source Address 52:54:00:07:2a:b3	Type 0x0800	// Data e padding Oi host A //	Checksum 0xae05
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Switching



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	
5	
6	
7	
8	52:54:00:07:2a:b3

Se a entrada na tabela ficar muito tempo sem uso ela é removida!

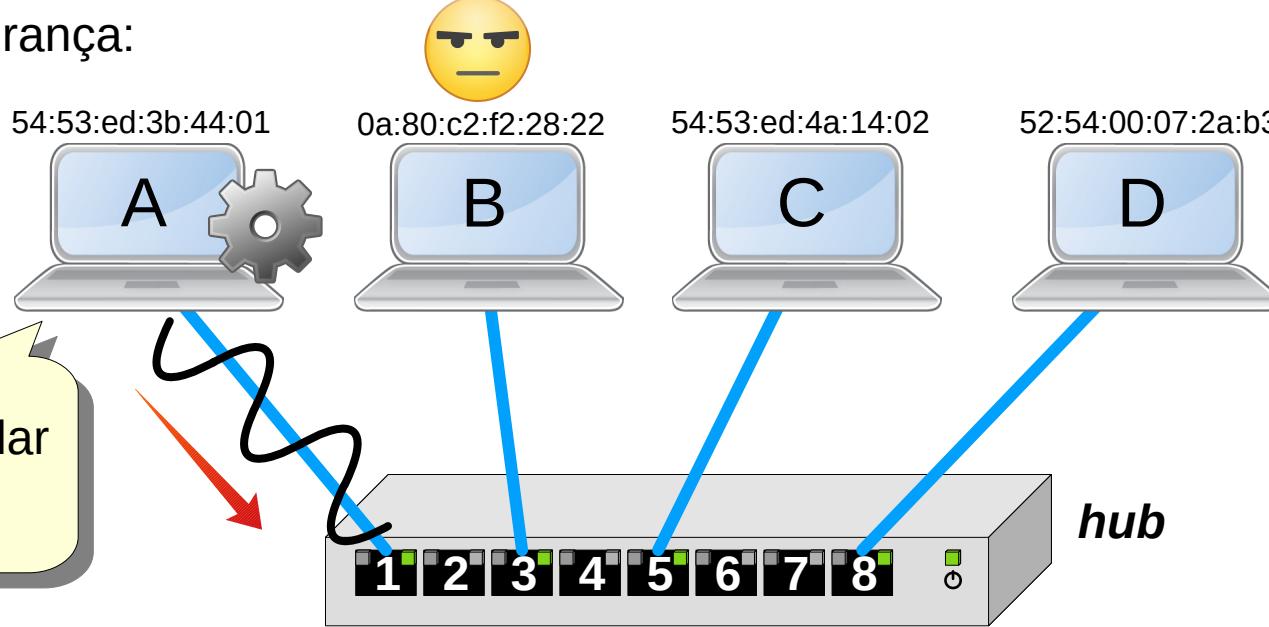
Switching

Não entendi as vantagens do *switch* em relação ao *hub*!



Switching

Segurança:



Preamble+SFD
10101010..10101011

Destination Address
52:54:00:07:2a:b3

Source Address
54:53:ed:3b:44:01

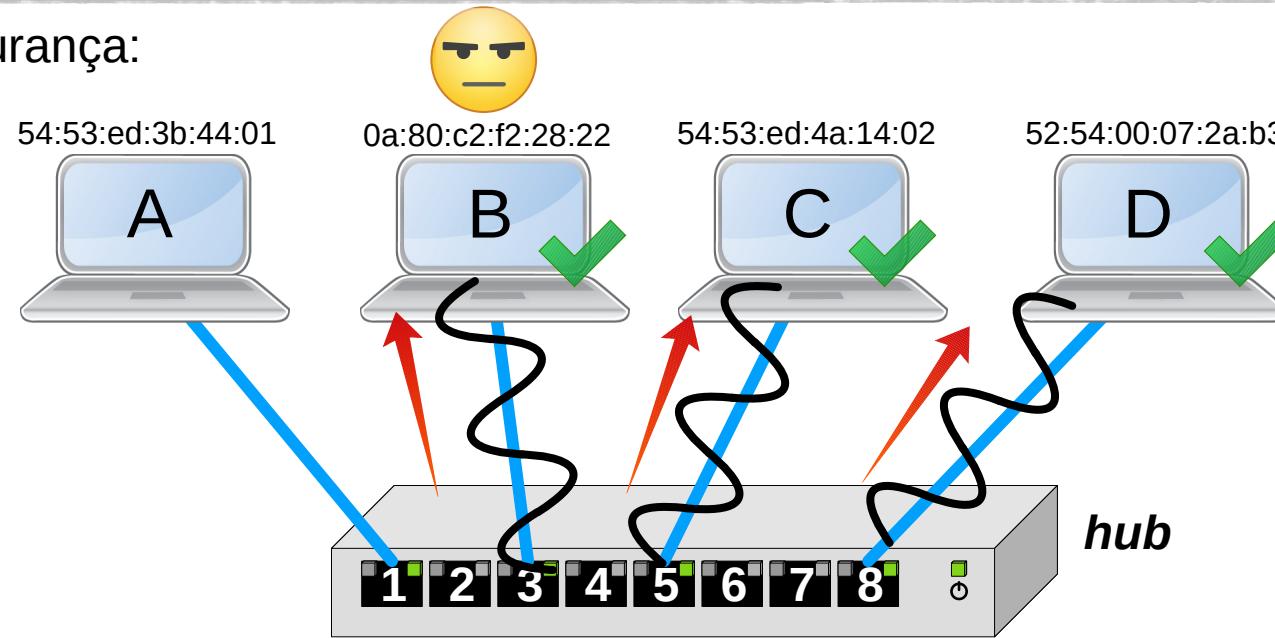
Type
0x0800

//
Data e padding
Olá
//

Checksum
0xaf81

Switching

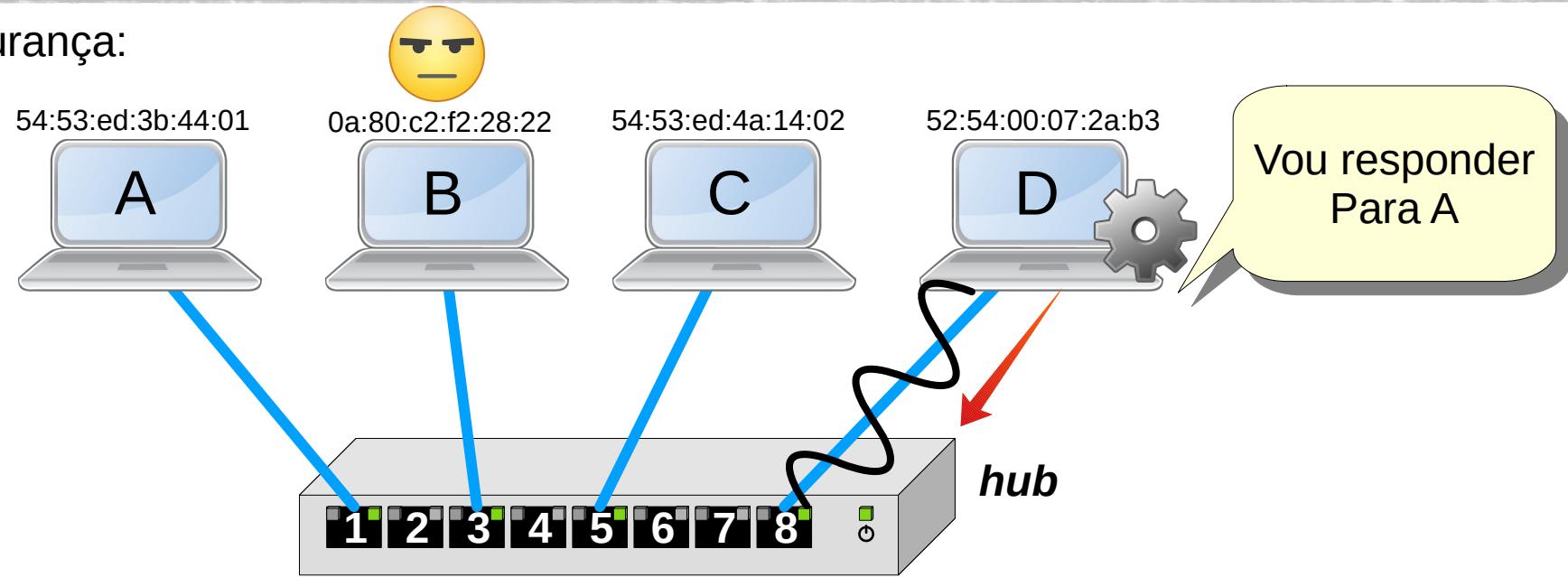
Segurança:



Preamble+SFD 10101010..10101011	Destination Address 52:54:00:07:2a:b3	Source Address 54:53:ed:3b:44:01	Type 0x0800	// Data e padding Olá //	Checksum 0xaf81
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Switching

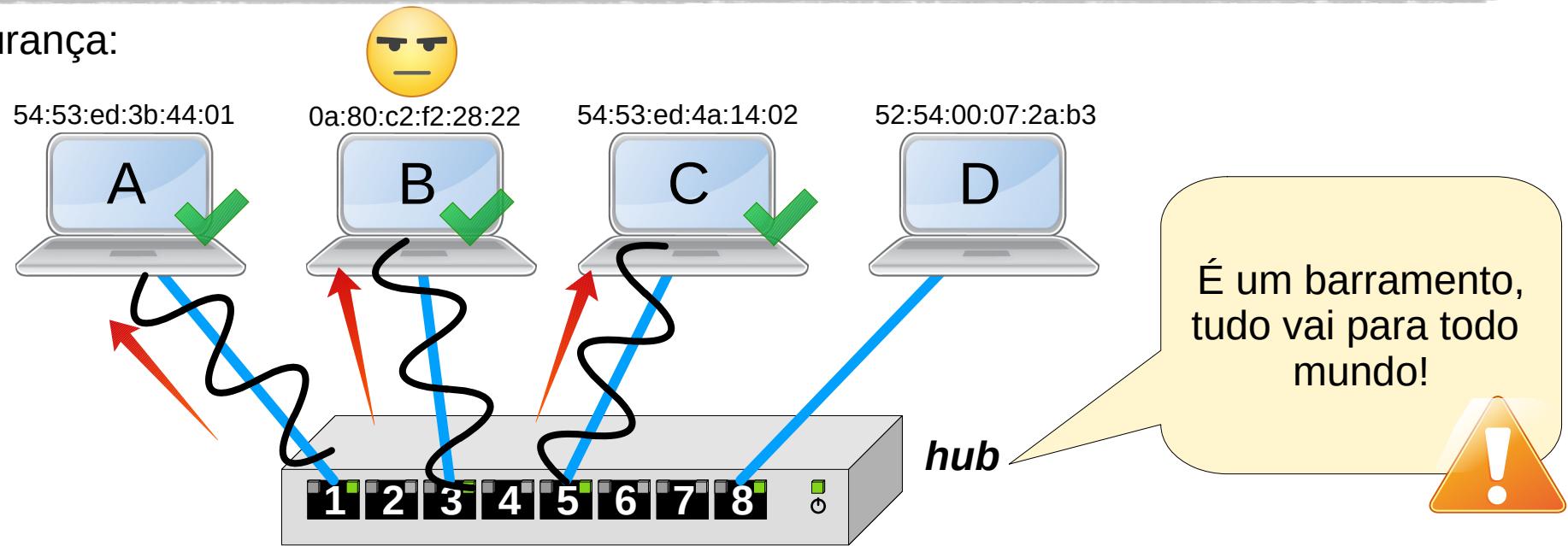
Segurança:



Preamble+SFD 10101010..10101011	Destination Address 54:53:ed:3b:44:01	Source Address 52:54:00:07:2a:b3	Type 0x0800	// Data e padding Olá //	Checksum 0xaf81
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Switching

Segurança:



Preamble+SFD <u>10101010..10101011</u>	Destination Address 54:53:ed:3b:44:01	Source Address 52:54:00:07:2a:b3	Type 0x0800	// Data e padding Olá //	Checksum 0xaf81
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Switching

Velocidade:

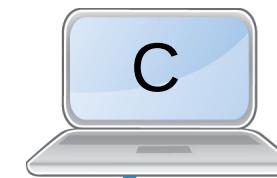
54:53:ed:3b:44:01



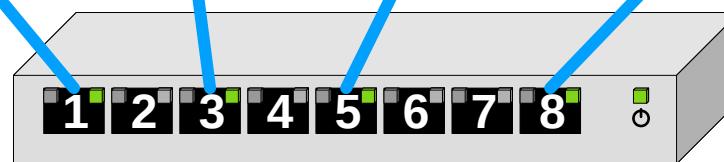
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



52:54:00:07:2a:b3



Switch

Ao contrário de um barramento (*hub*), com *switch* é possível ter mais de uma transmissão simultânea...



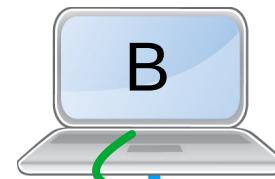
Switching

Velocidade:

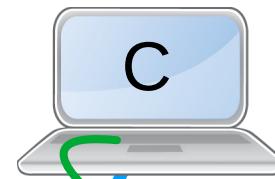
54:53:ed:3b:44:01



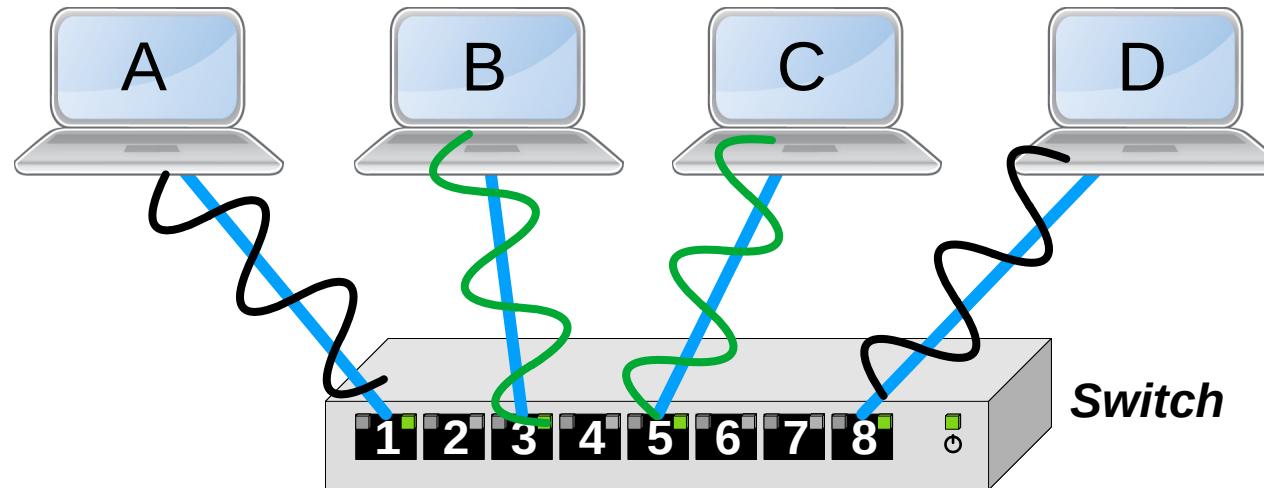
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



52:54:00:07:2a:b3



Switching

**Entendi... switch é mais veloz
e mais seguro que um barramento!**



Switching

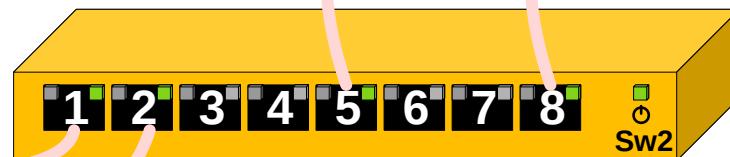
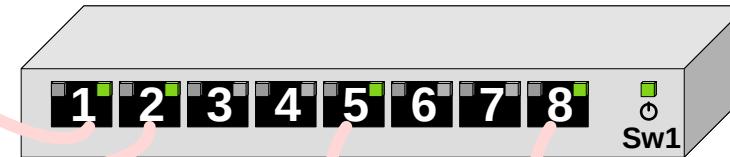
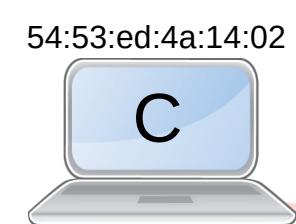
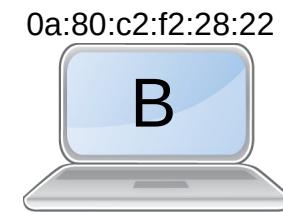
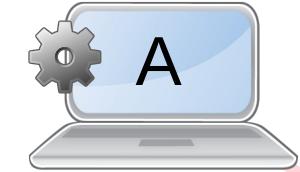
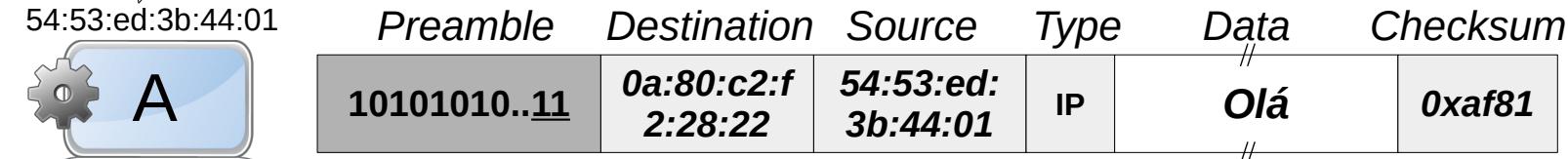
**Entendi... switch é mais veloz
e mais seguro que um barramento!**



Mas existem
problemas!

Vou falar
Com B

Switching



Switching

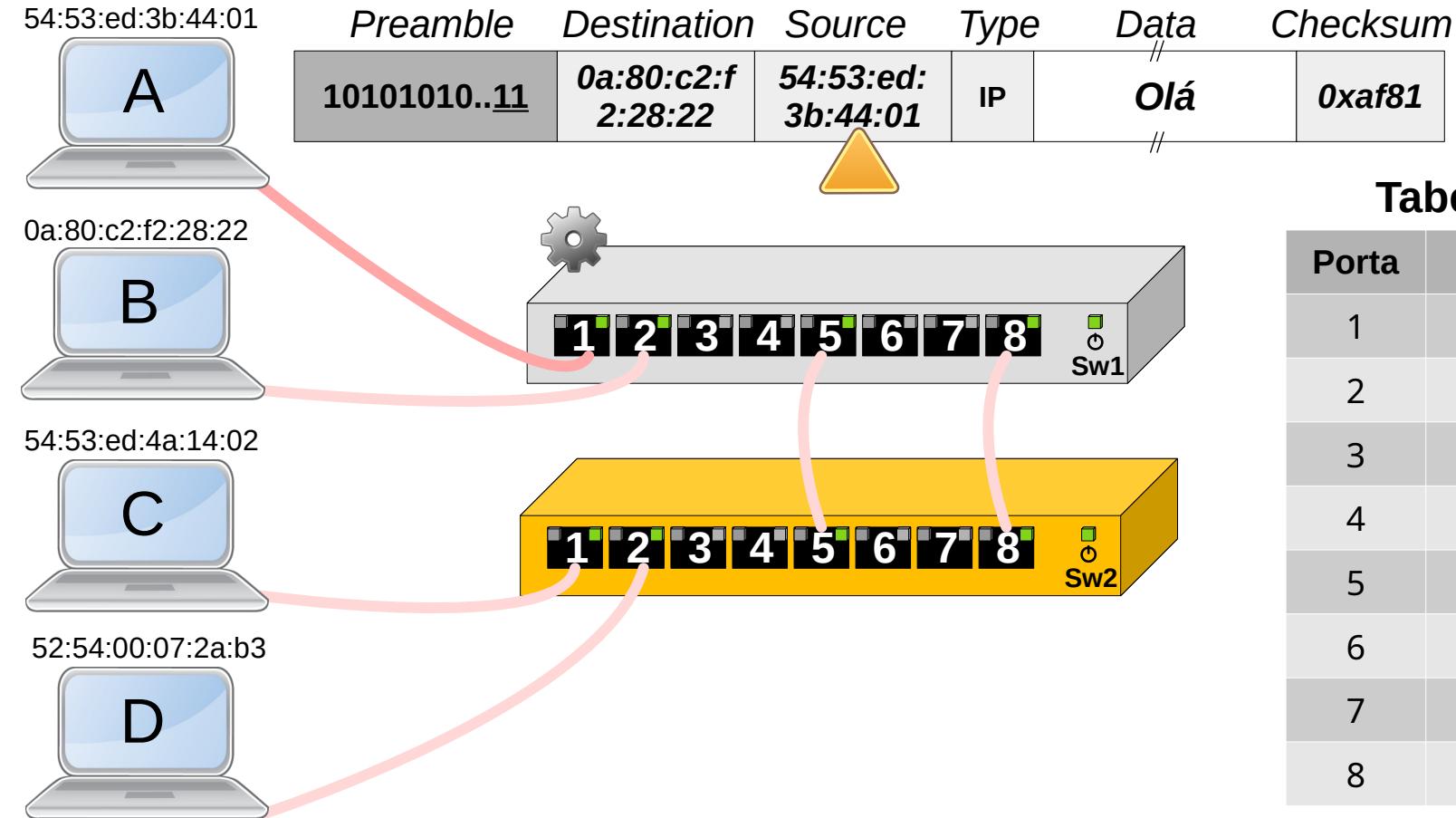


Tabela Switch 1

Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	
5	
6	
7	
8	

Switching

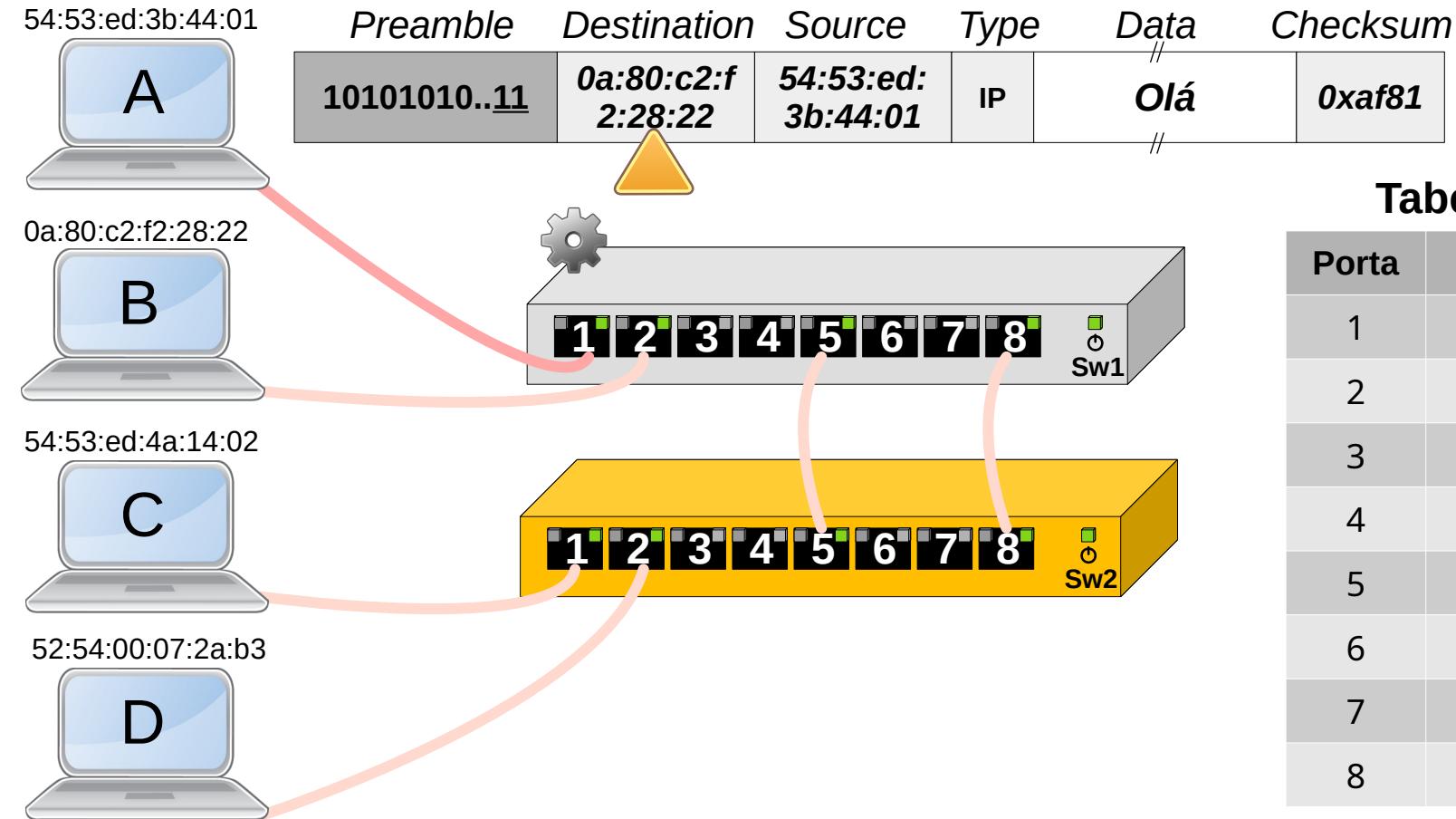


Tabela Switch 1

Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	?
5	
6	
7	
8	

Switching

54:53:ed:3b:44:01	Preamble	Destination	Source	Type	Data // Olá //	Checksum 0xaf81
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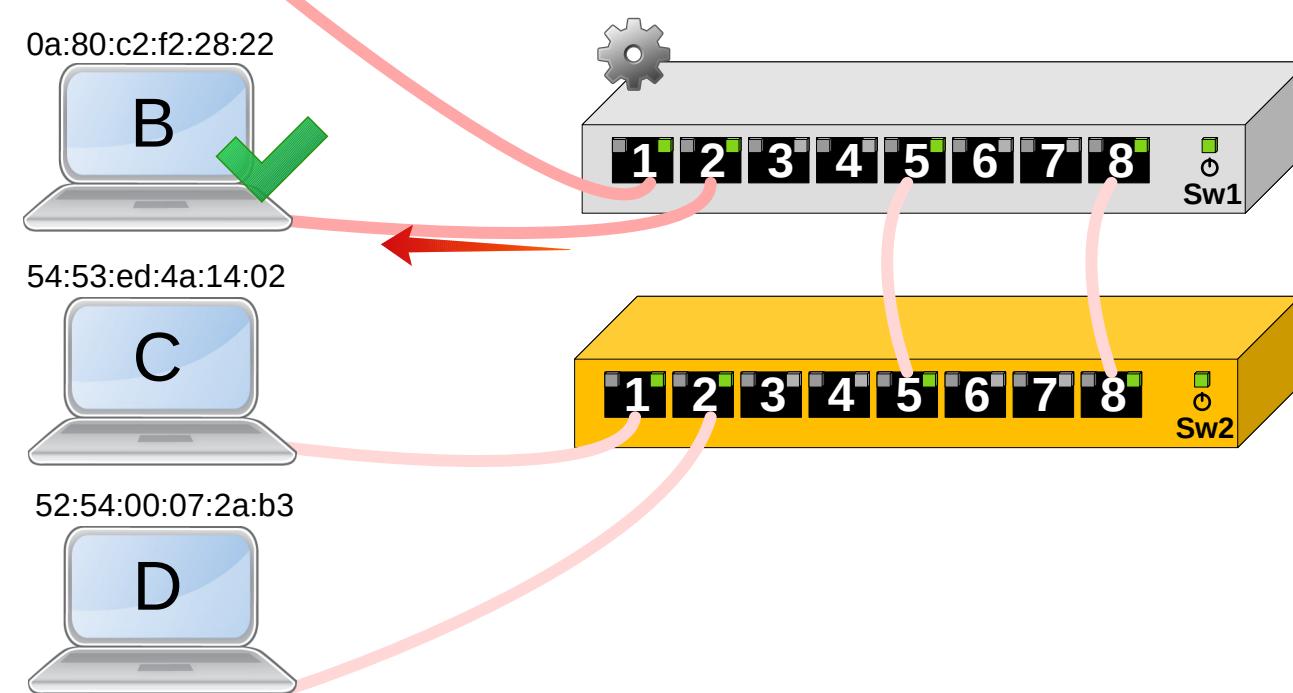


Tabela Switch 1

Porta	Hosts
1	54:53:ed:3b:44:01
2	Enviar...
3	
4	
5	
6	
7	
8	

Switching

54:53:ed:3b:44:01	Preamble	Destination	Source	Type	Data // Olá //	Checksum 0xaf81
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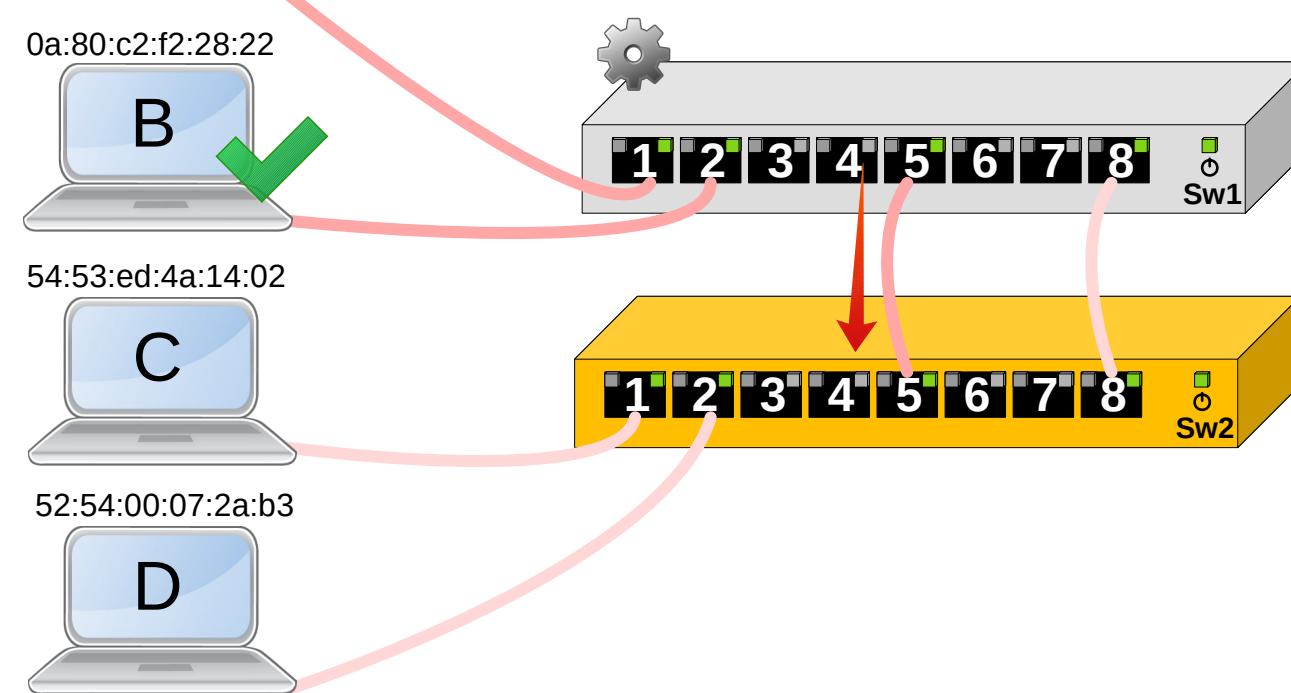


Tabela Switch 1

Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	
5	54:53:ed:3b:44:01
6	
7	
8	

← Enviar...

Switching

54:53:ed:3b:44:01	Preamble	Destination	Source	Type	Data // Olá //	Checksum 0xaf81
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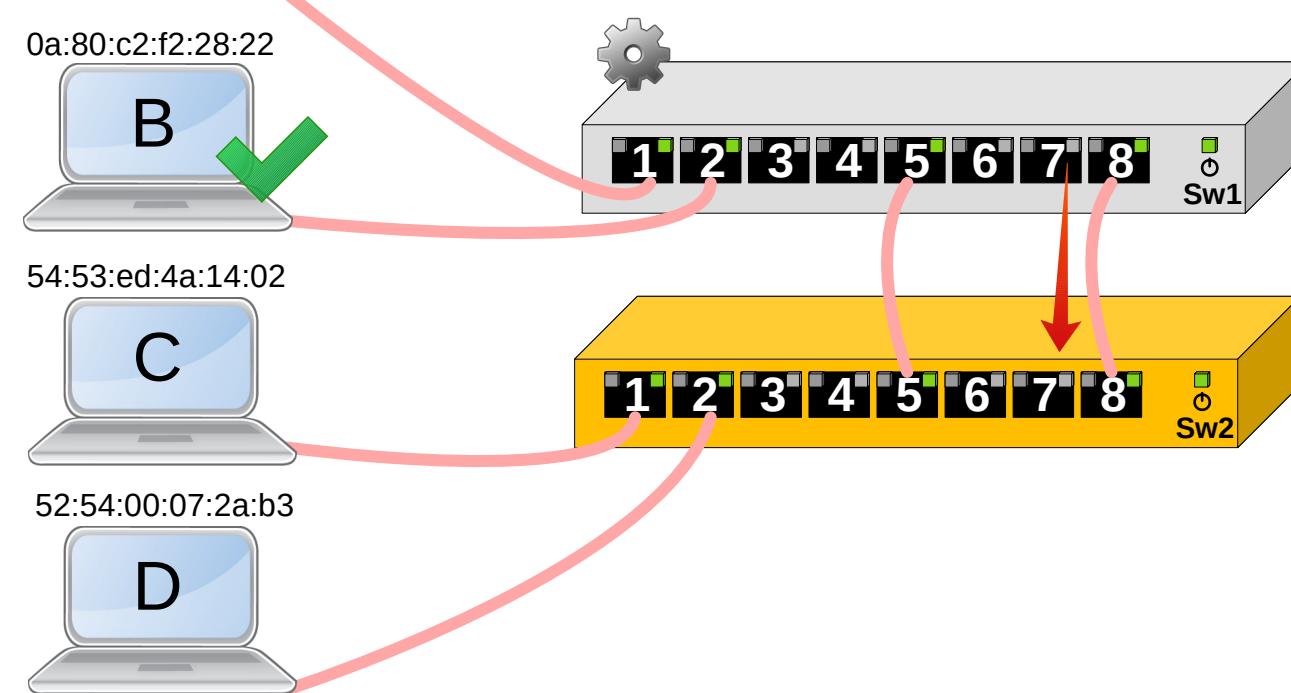


Tabela Switch 1

Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	
5	
6	
7	
8	← Enviar...

Switching

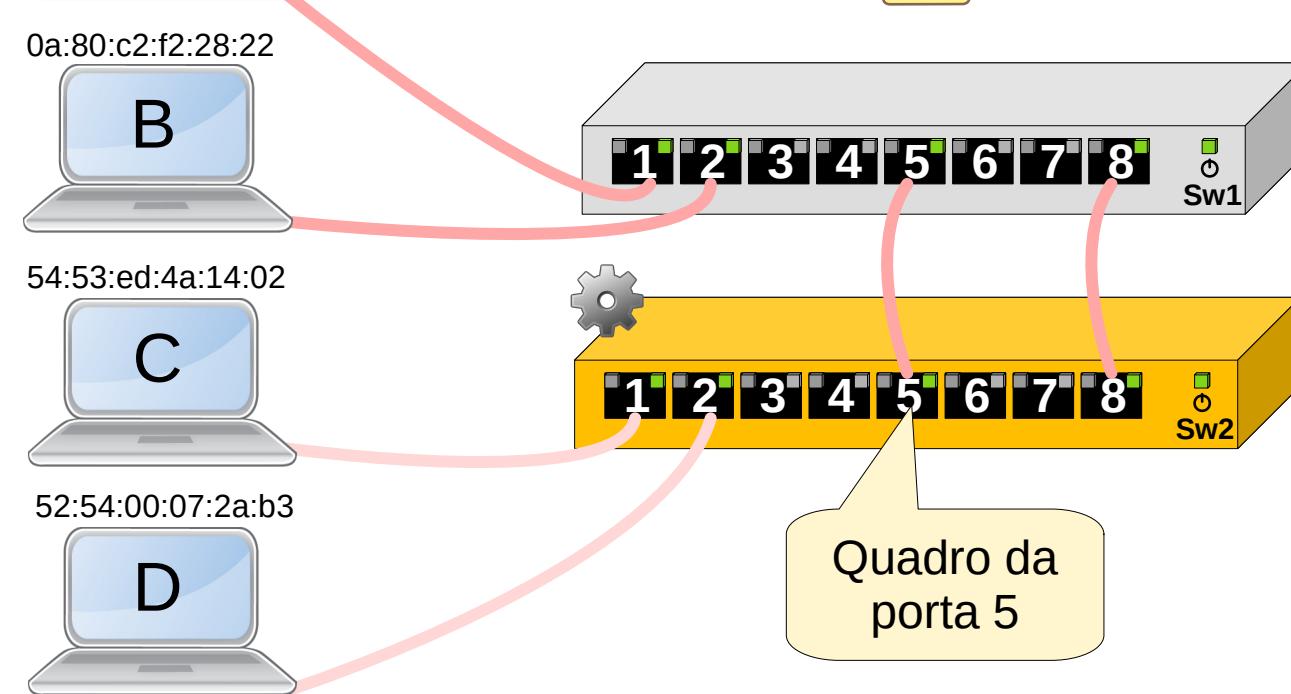
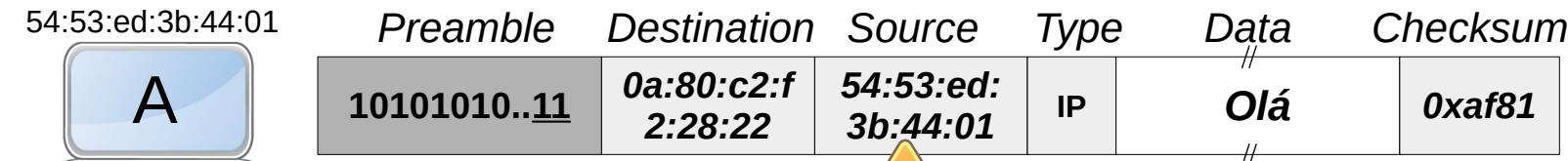


Tabela Switch 2

Porta	Hosts
1	
2	
3	
4	
5	54:53:ed:3b:44:01
6	
7	
8	

Vou falar
Com B

Switching

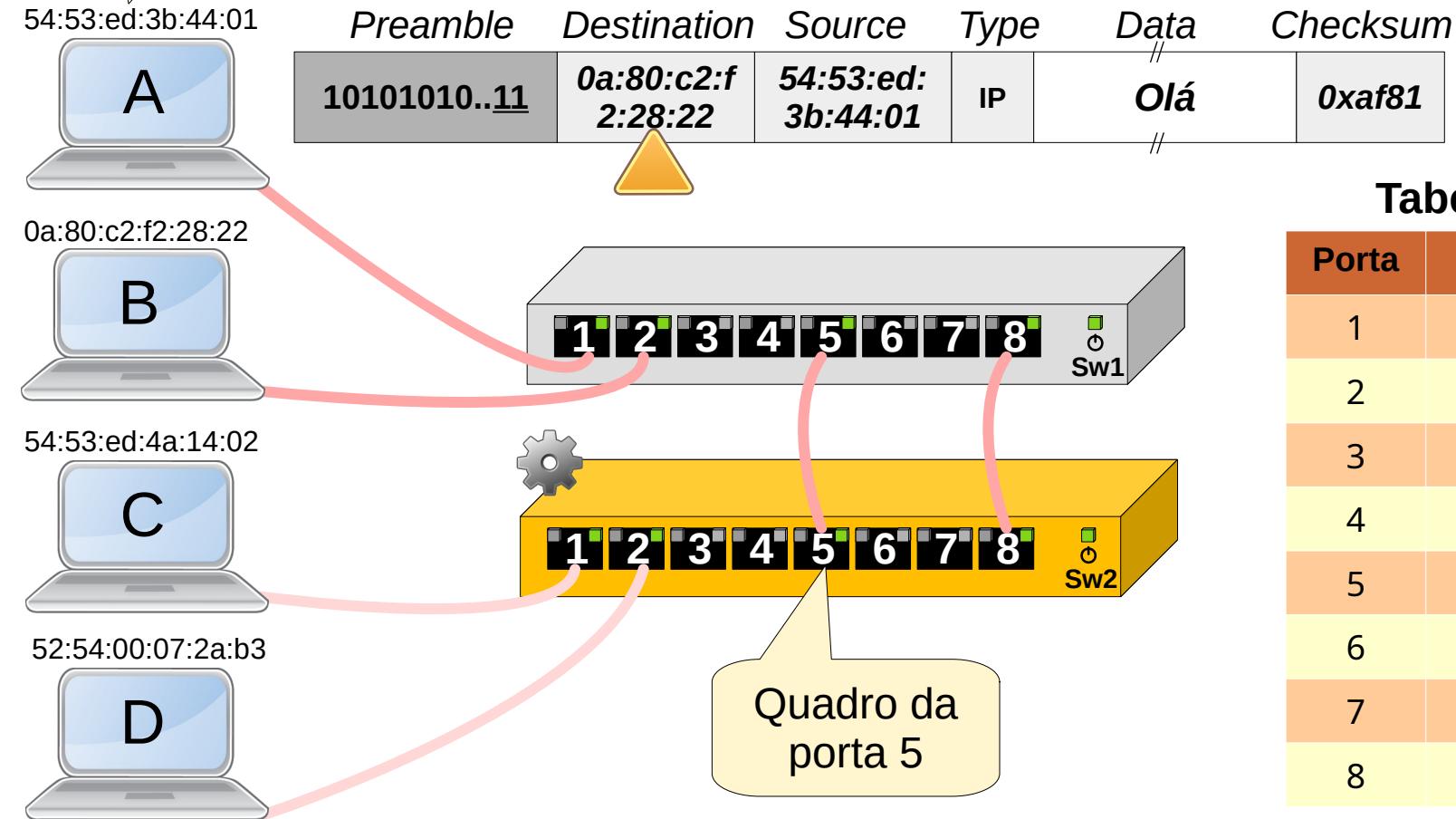


Tabela Switch 2

Porta	Hosts
1	
2	
3	?
4	
5	54:53:ed:3b:44:01
6	
7	
8	

Vou falar
Com B

Switching

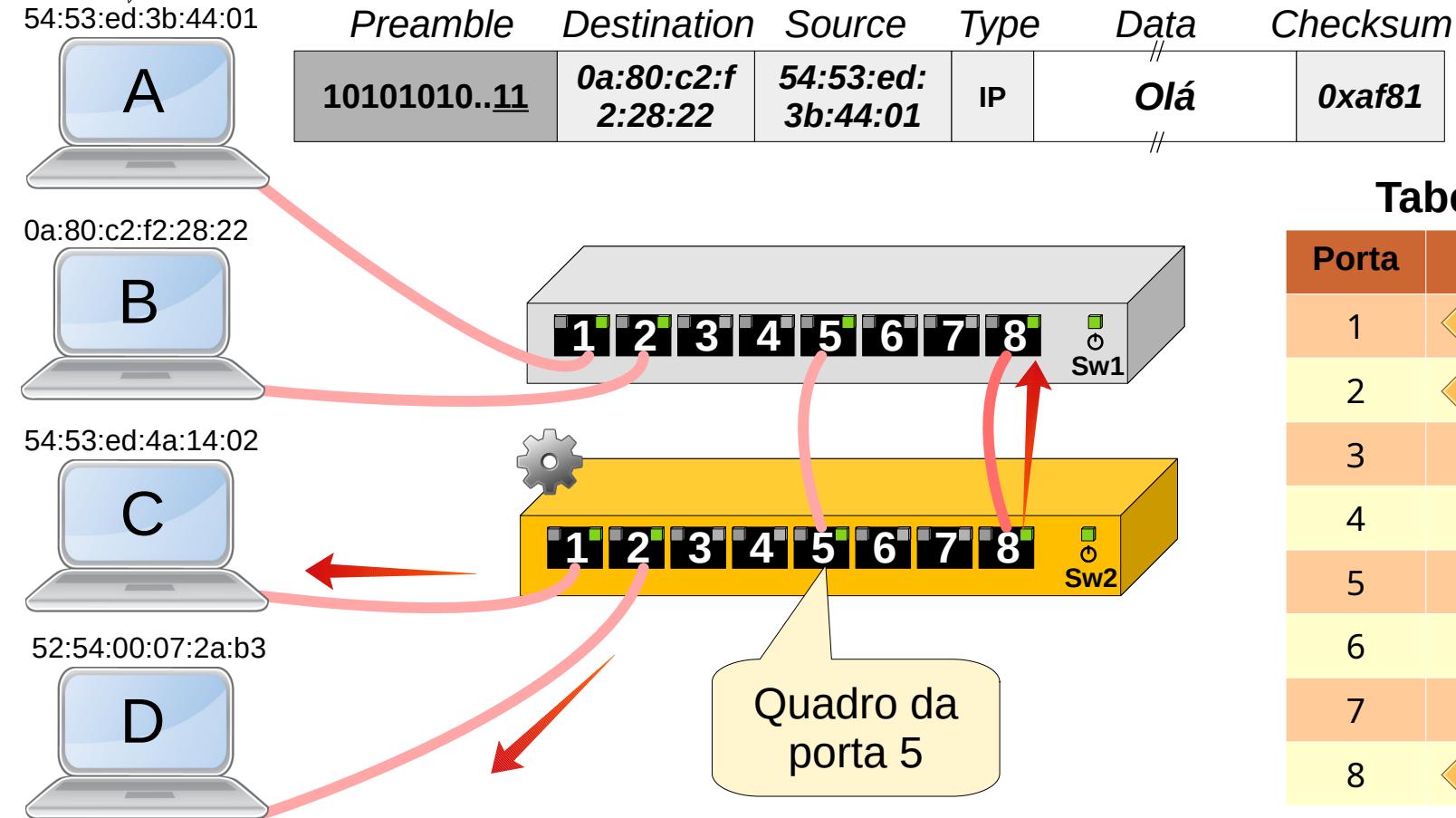


Tabela Switch 2

Porta	Hosts
1	Enviar...
2	Enviar...
3	
4	
5	54:53:ed:3b:44:01
6	
7	
8	Enviar...

Vou falar
Com B

Switching

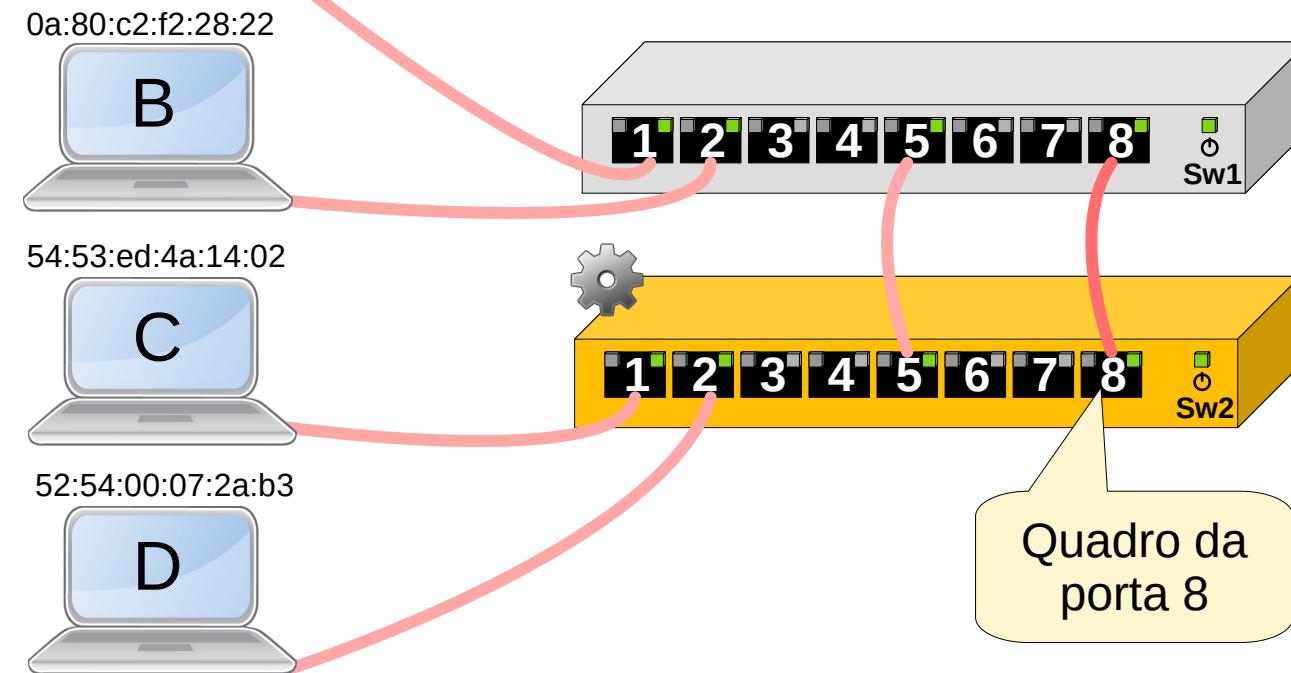
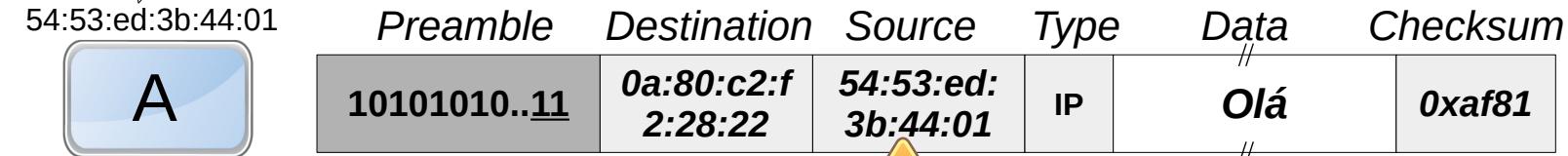


Tabela Switch 2

Porta	Hosts
1	
2	
3	
4	
5	54:53:ed:3b:44:01
6	
7	
8	54:53:ed:3b:44:01

Switching

Vou falar
Com B

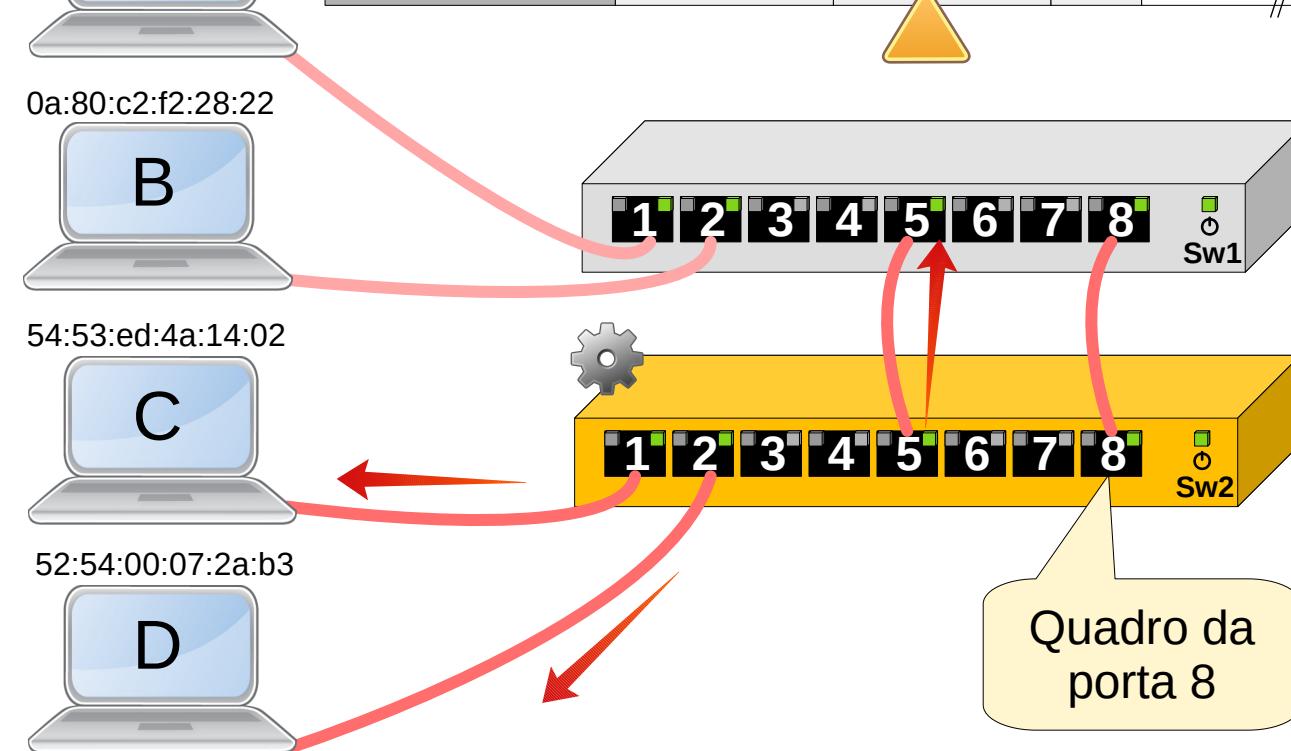
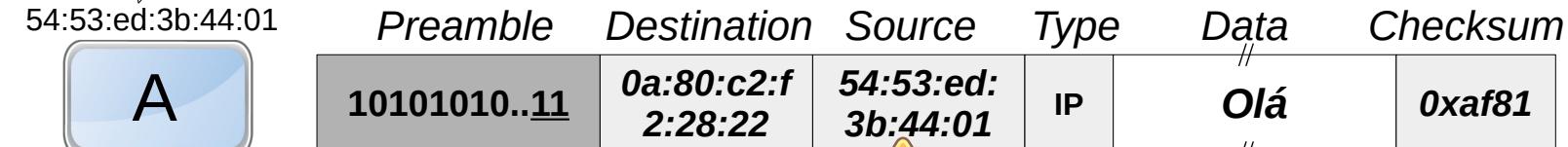
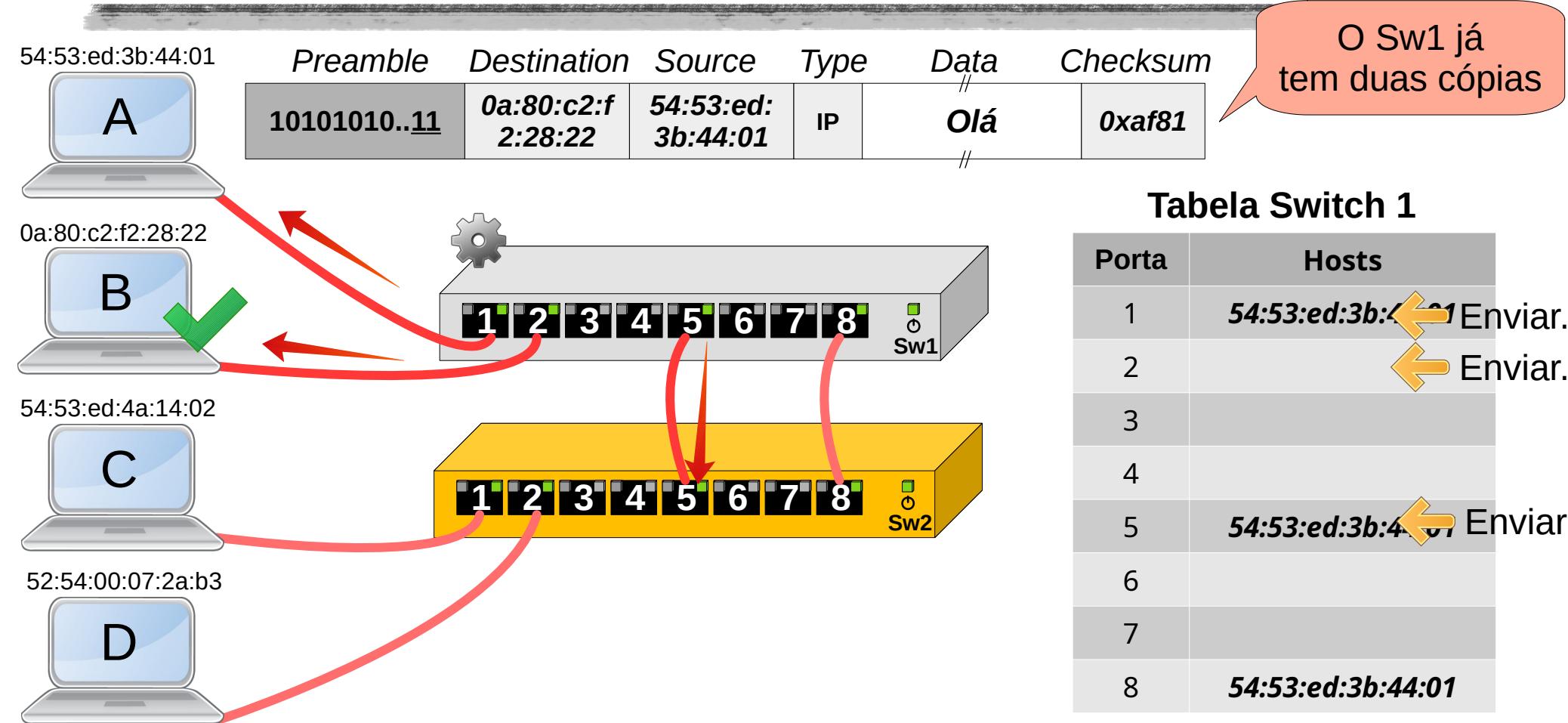


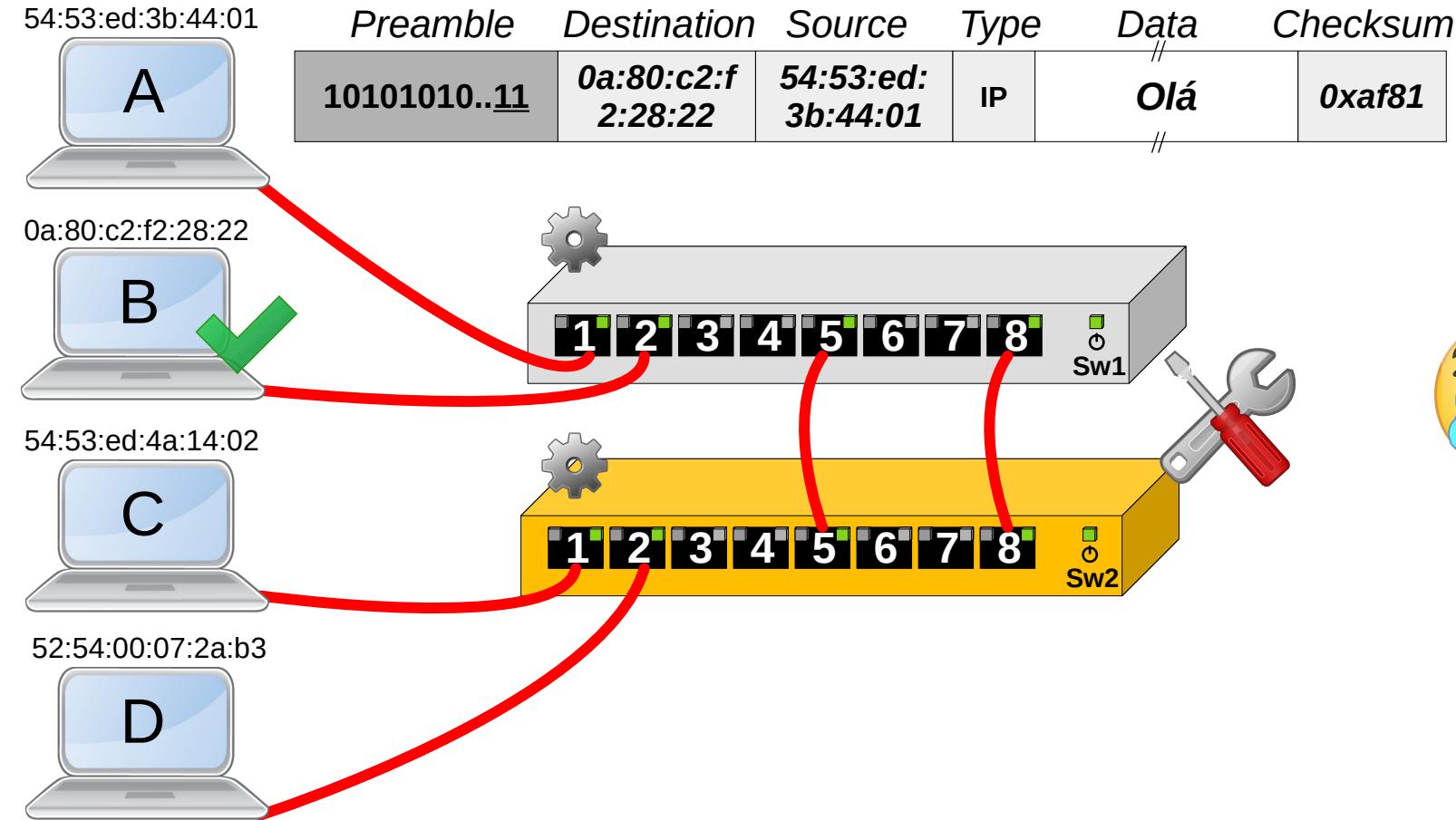
Tabela Switch 2

Porta	Hosts
1	Enviar...
2	Enviar...
3	
4	
5	54:53:ed:3b:44:01
6	
7	
8	54:53:ed:3b:44:01

Switching



Switching



Switching

Quando isso termina?

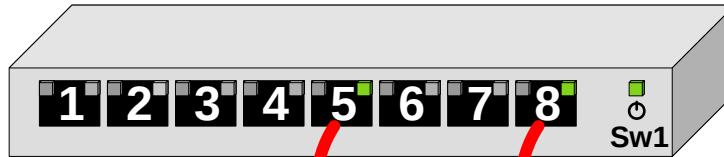
Como resolver isso?



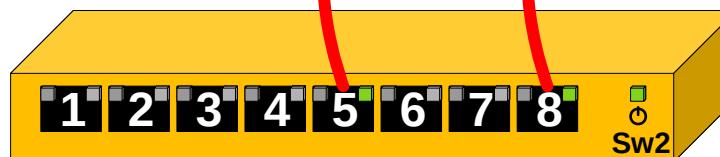
STP

Switching

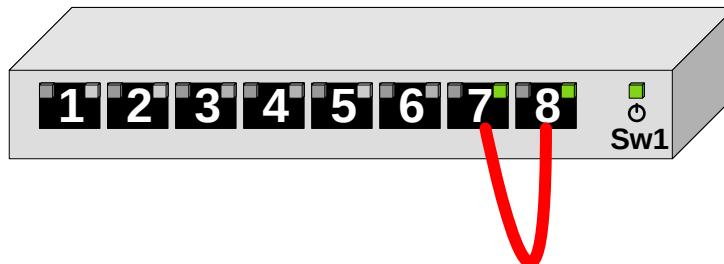
Lembrando antes, que o problema do *loop* pode acontecer em vários cenários:



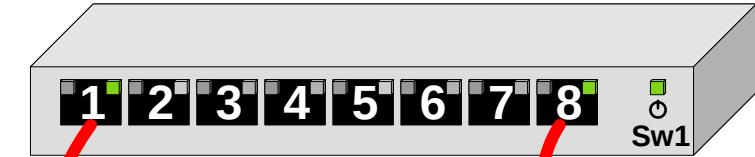
(a)



(b)



(c)



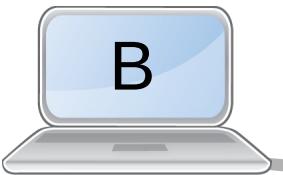
Switching

54:53:ed:3b:44:01

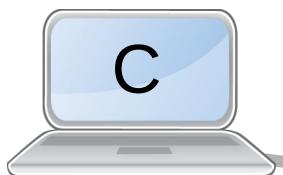


Solução com STP

0a:80:c2:f2:28:22



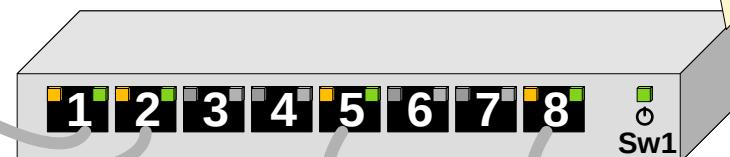
54:53:ed:4a:14:02



52:54:00:07:2a:b3



Quem o
Sw raiz?

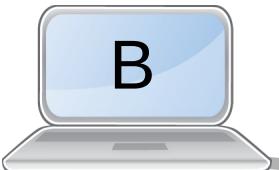


Switching

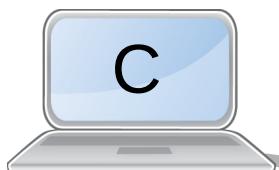
54:53:ed:3b:44:01



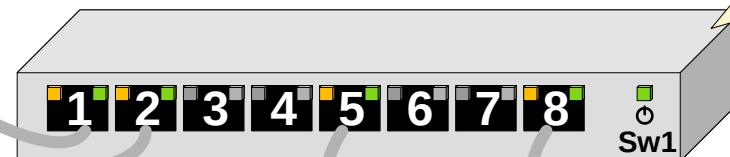
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



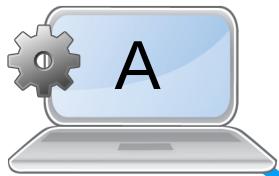
52:54:00:07:2a:b3



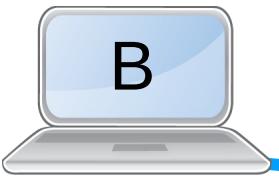
Eu sou o menor, logo sou o raiz,
então vou executar
o STP

Switching

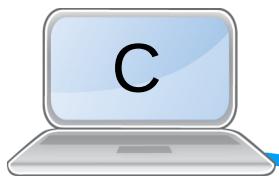
54:53:ed:3b:44:01



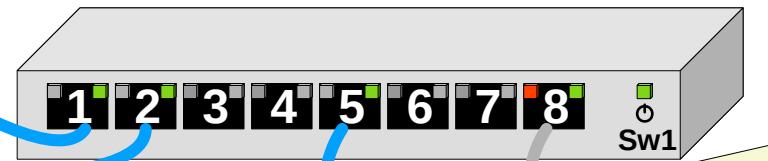
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



52:54:00:07:2a:b3

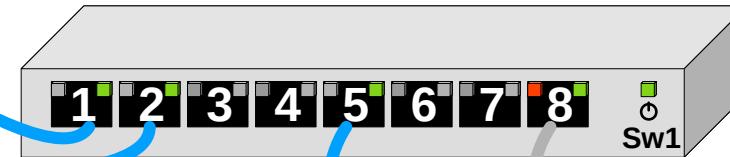
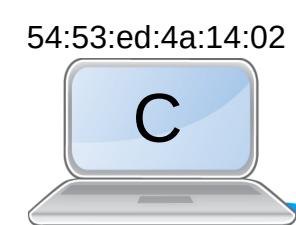
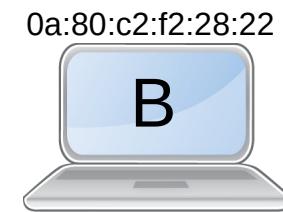
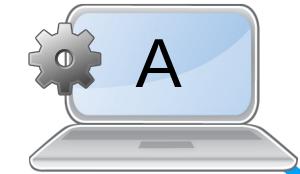


Aqui tem um loop,
então ficará desativada...

Switching

Vou falar
Com B

54:53:ed:3b:44:01	Preamble	Destination	Source	Type	Data	Checksum
	10101010.. <u>11</u>	0a:80:c2:f2:28:22	54:53:ed:3b:44:01	IP	Olá	0xaf81



Switching

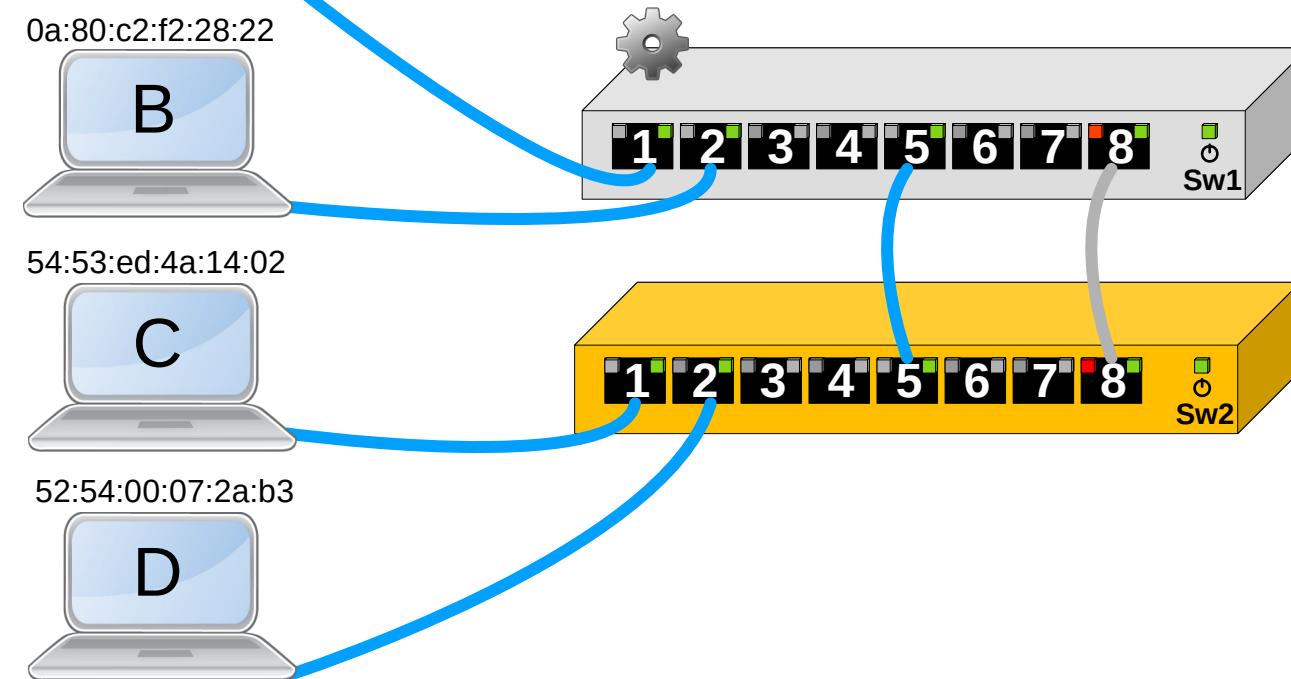
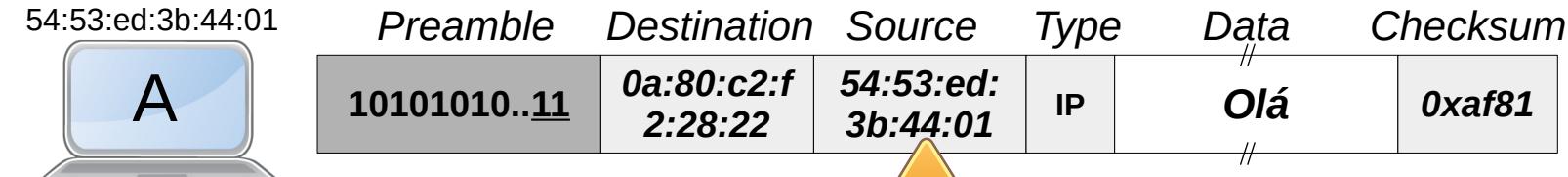


Tabela Switch 1

Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	
5	
6	
7	
8	Desativada!

Switching

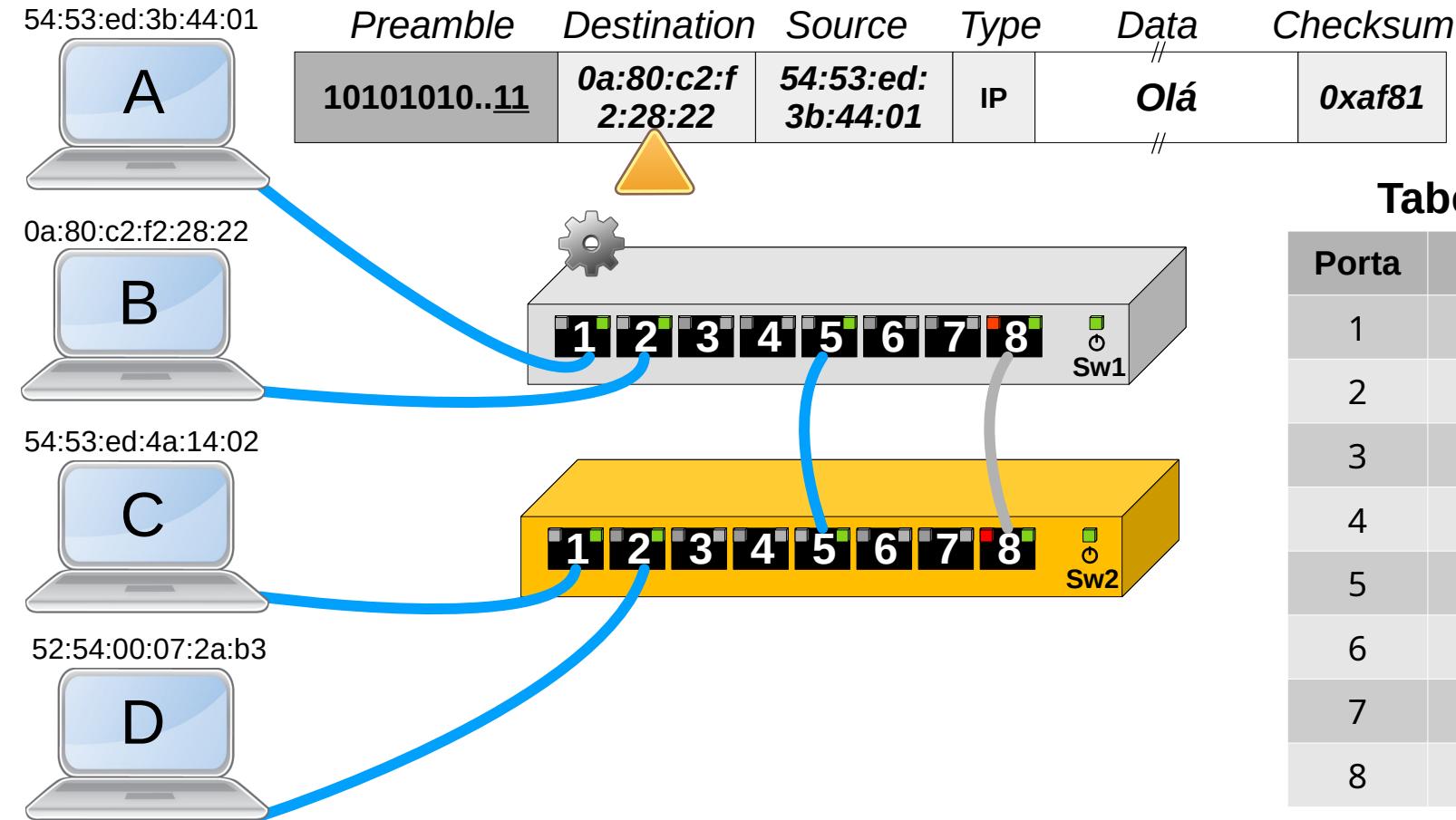


Tabela Switch 1

Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	
4	?
5	
6	
7	
8	Desativada!

Switching

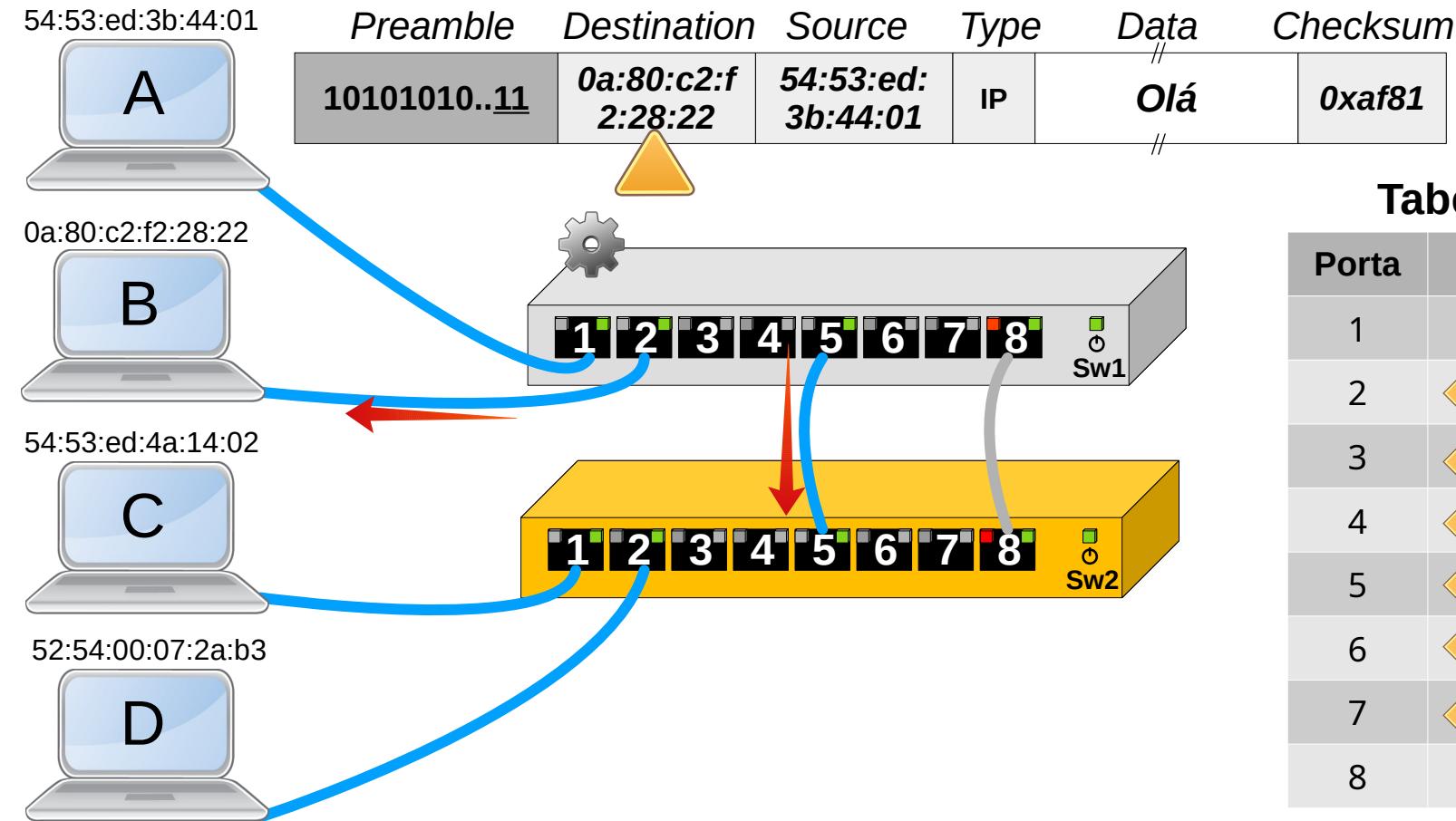


Tabela Switch 1

Porta	Hosts
1	54:53:ed:3b:44:01
2	Enviar...
3	Enviar...
4	Enviar...
5	Enviar...
6	Enviar...
7	Enviar...
8	Desativada!

Switching

54:53:ed:3b:44:01	Preamble	Destination	Source	Type	Data	Checksum
	10101010.. <u>11</u>	0a:80:c2:f 2:28:22	54:53:ed: 3b:44:01	IP	// Olá //	0xaf81

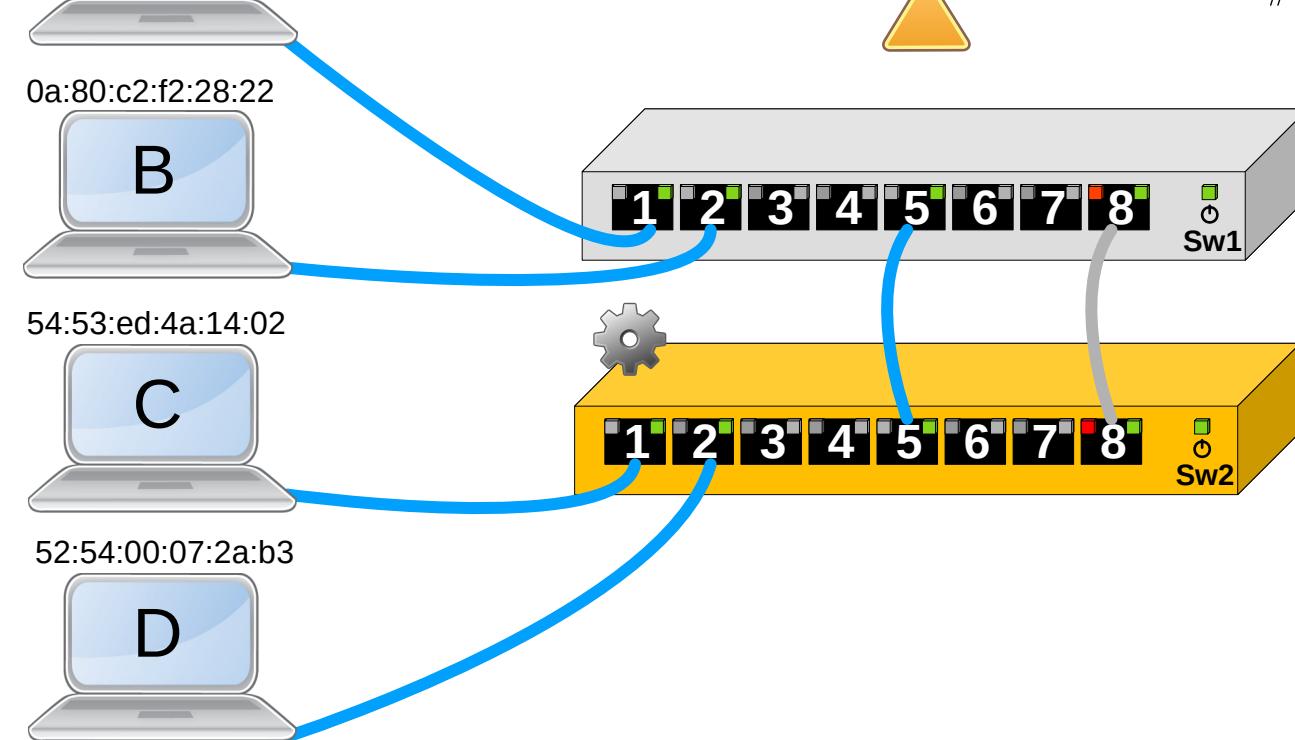


Tabela Switch 2

Porta	Hosts
1	
2	
3	
4	
5	54:53:ed:3b:44:01
6	
7	
8	Desativada!

Switching

54:53:ed:3b:44:01	Preamble	Destination	Source	Type	Data	Checksum
	10101010.. <u>11</u>	0a:80:c2:f 2:28:22	54:53:ed: 3b:44:01	IP	// Olá //	0xaf81

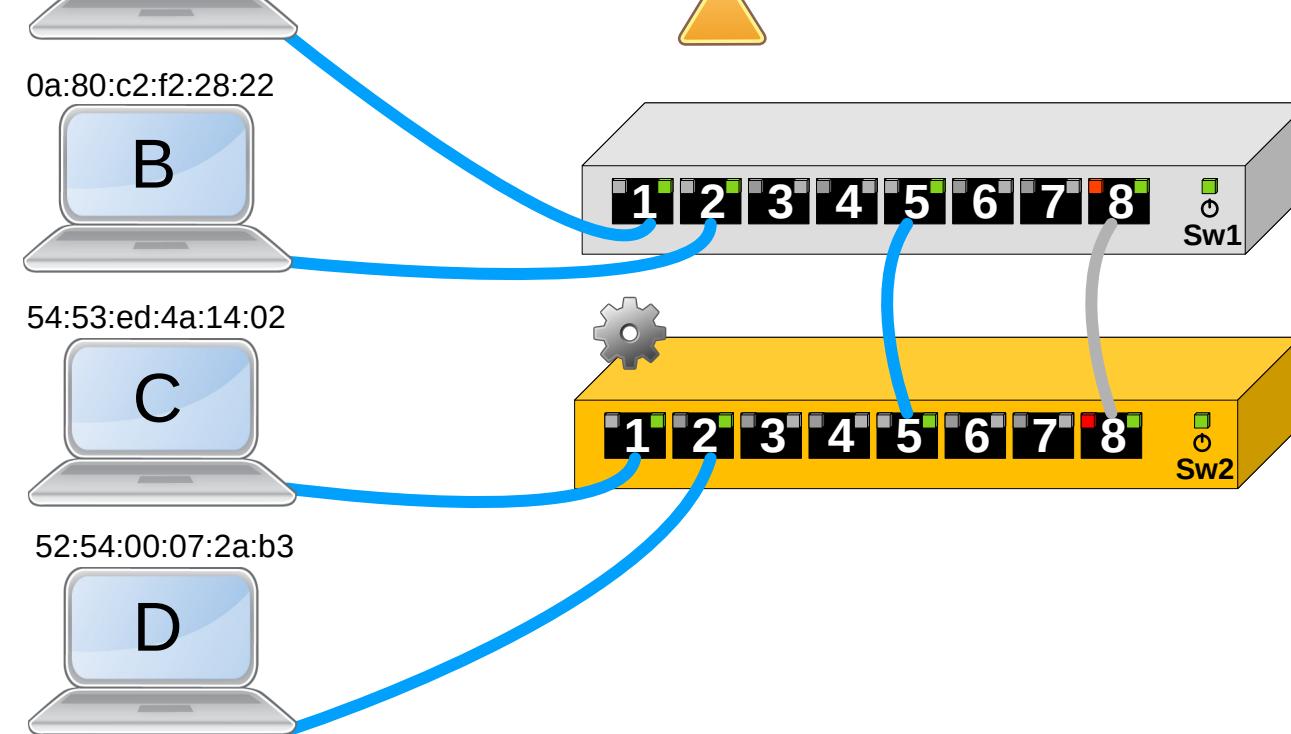


Tabela Switch 2

Porta	Hosts
1	
2	
3	
4	
5	54:53:ed:3b:44:01
6	
7	
8	Desativada!

Switching

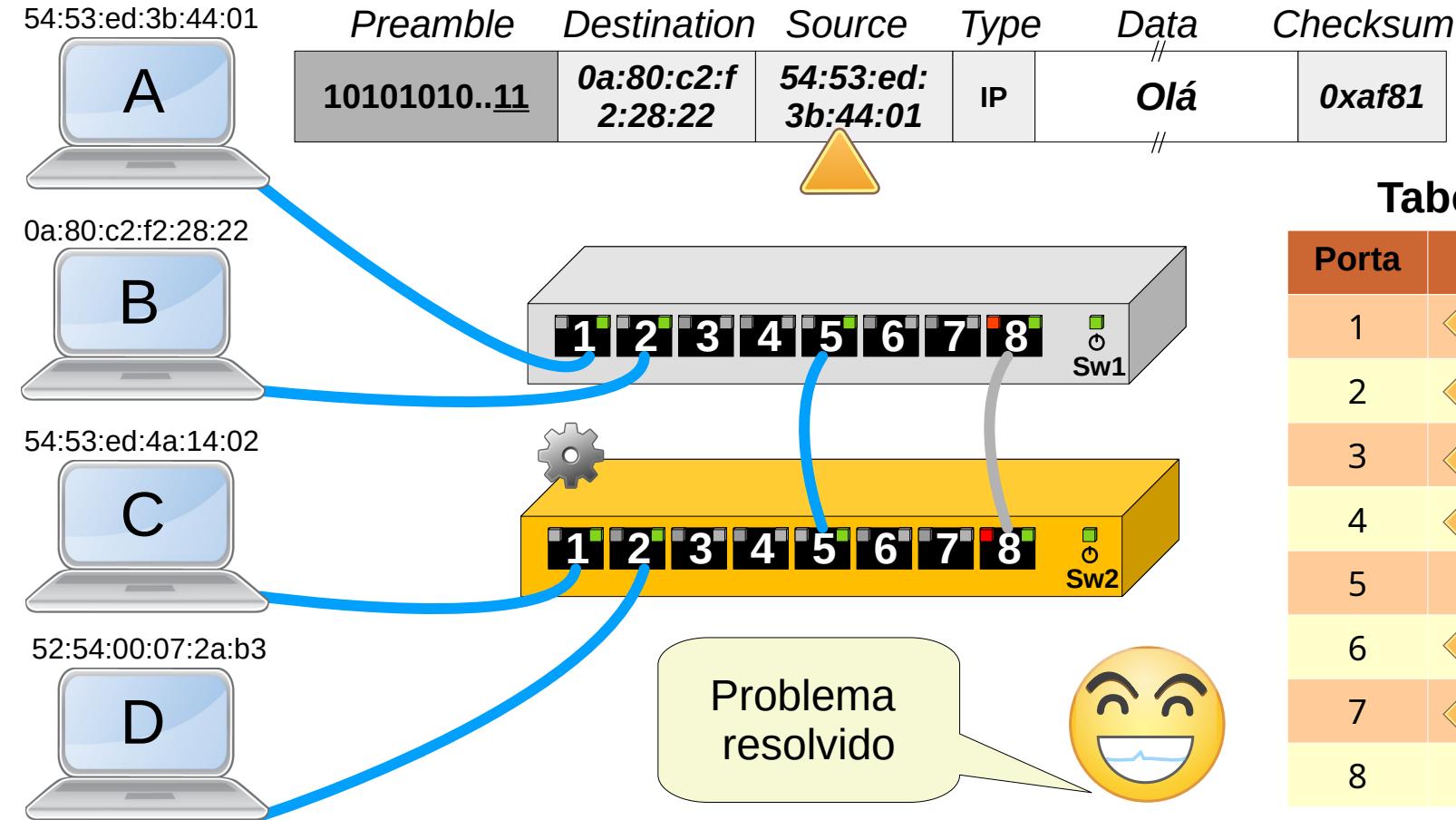


Tabela Switch 2

Porta	Hosts
1	Enviar...
2	Enviar...
3	Enviar...
4	Enviar...
5	54:53:ed:3b:44:01
6	Enviar...
7	Enviar...
8	Desativada!

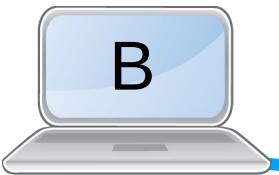
Switching

54:53:ed:3b:44:01

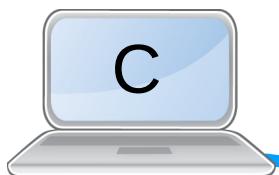


Em caso de falhas o STP pode redefinir os caminhos

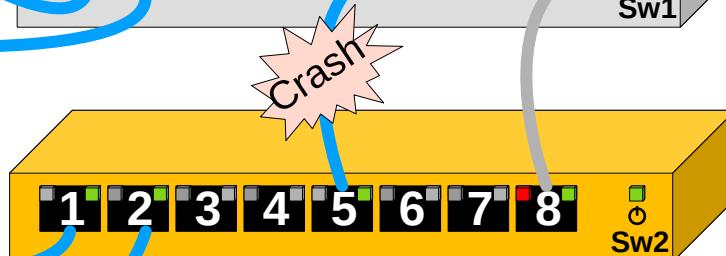
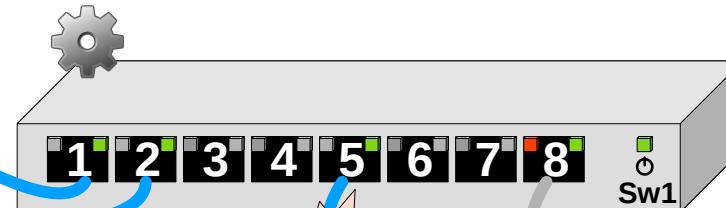
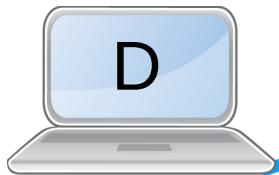
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



52:54:00:07:2a:b3



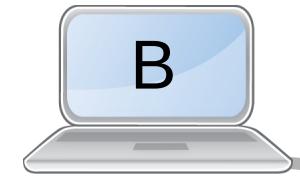
Switching

54:53:ed:3b:44:01



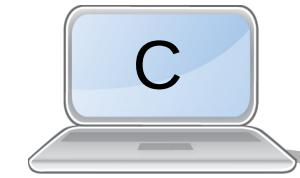
A

0a:80:c2:f2:28:22



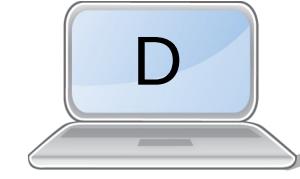
B

54:53:ed:4a:14:02



C

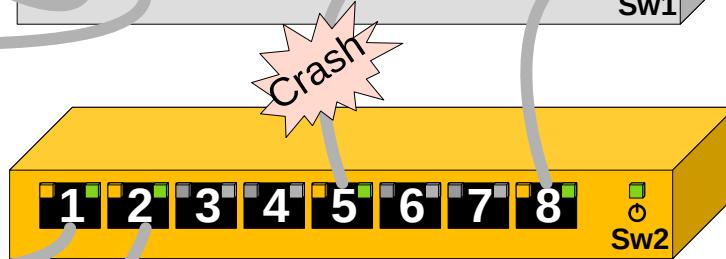
52:54:00:07:2a:b3



D



Rever
caminhos

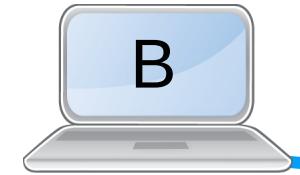


Switching

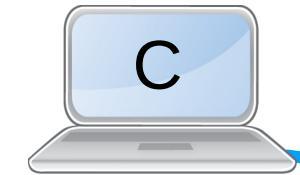
54:53:ed:3b:44:01



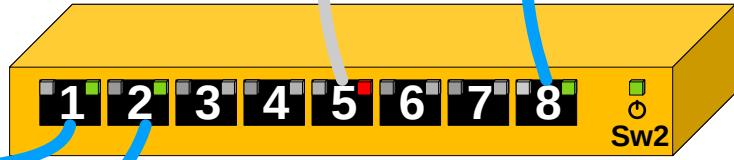
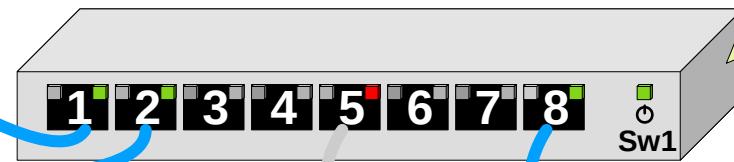
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



52:54:00:07:2a:b3



Pronto
conexão restabelecida...



Switching

Todos switches vêm com STP?

STP causa algum problema?



Switching

Há alguns tipos de comutação: ***Store and forward***

54:53:ed:3b:44:01



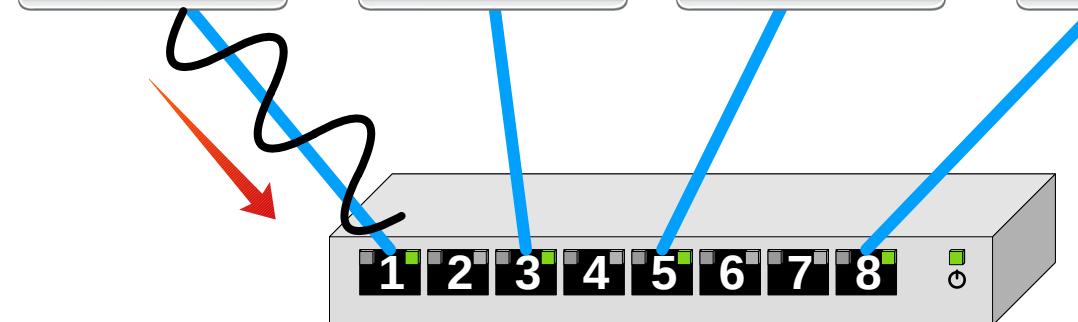
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



52:54:00:07:2a:b3

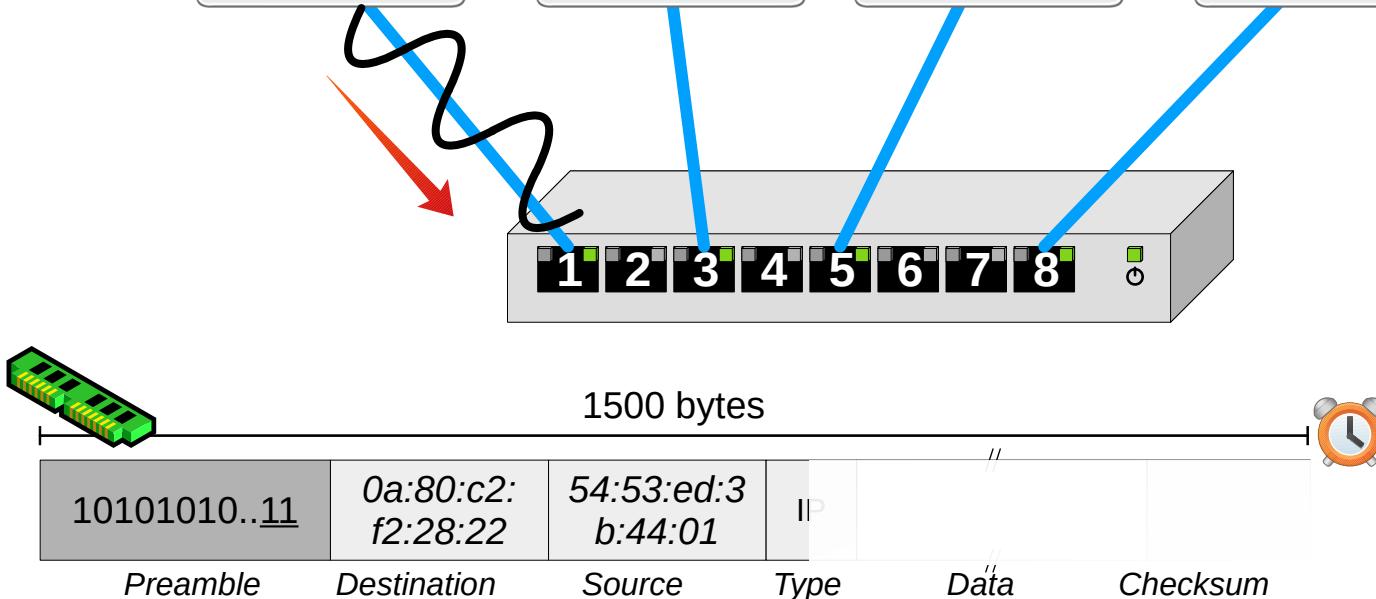
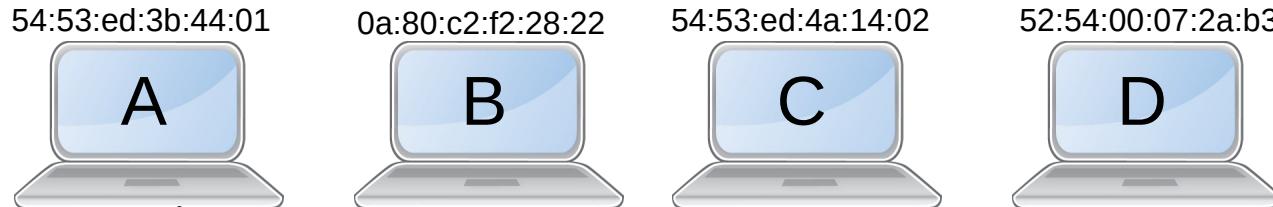


Preamble	Destination	Source	Type	Data	Checksum
10101010.. <u>11</u>	0a:80:c2: f2:28:22			"	

Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	0a:80:c2:f2:28:22
4	
5	54:53:ed:4a:14:02
6	
7	
8	52:54:00:07:2a:b3

Switching

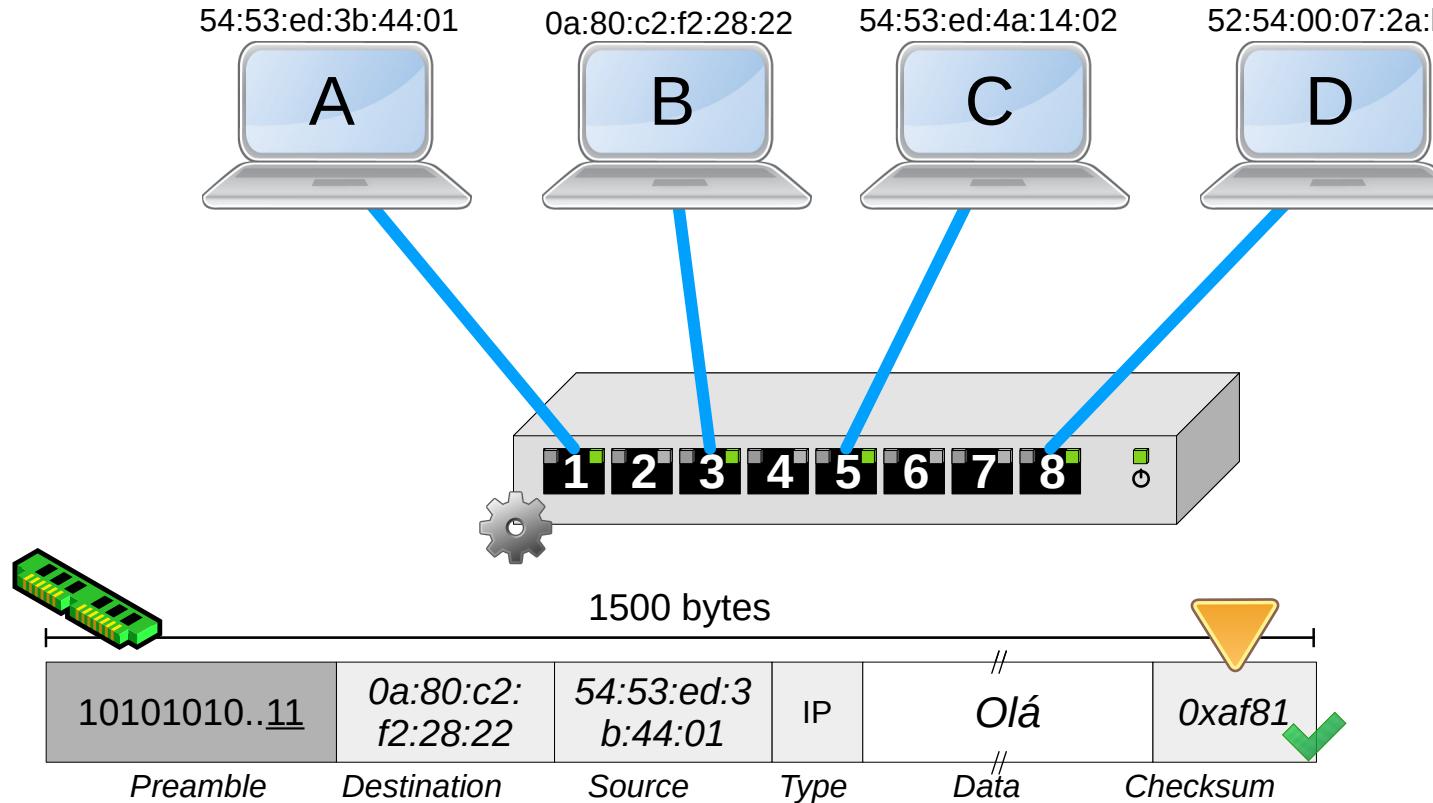
Há alguns tipos de comutação: ***Store and forward***



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	0a:80:c2:f2:28:22
4	
5	54:53:ed:4a:14:02
6	
7	
8	52:54:00:07:2a:b3

Switching

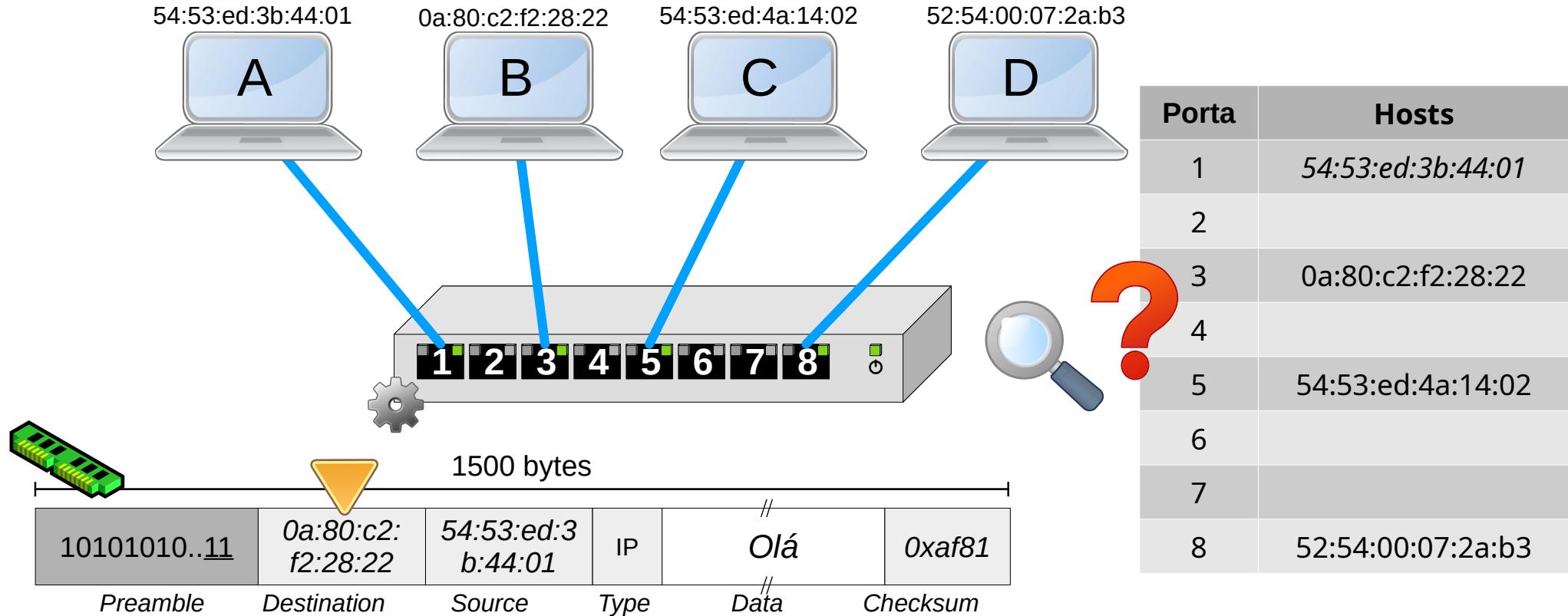
Há alguns tipos de comutação: ***Store and forward***



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	0a:80:c2:f2:28:22
4	
5	54:53:ed:4a:14:02
6	
7	
8	52:54:00:07:2a:b3

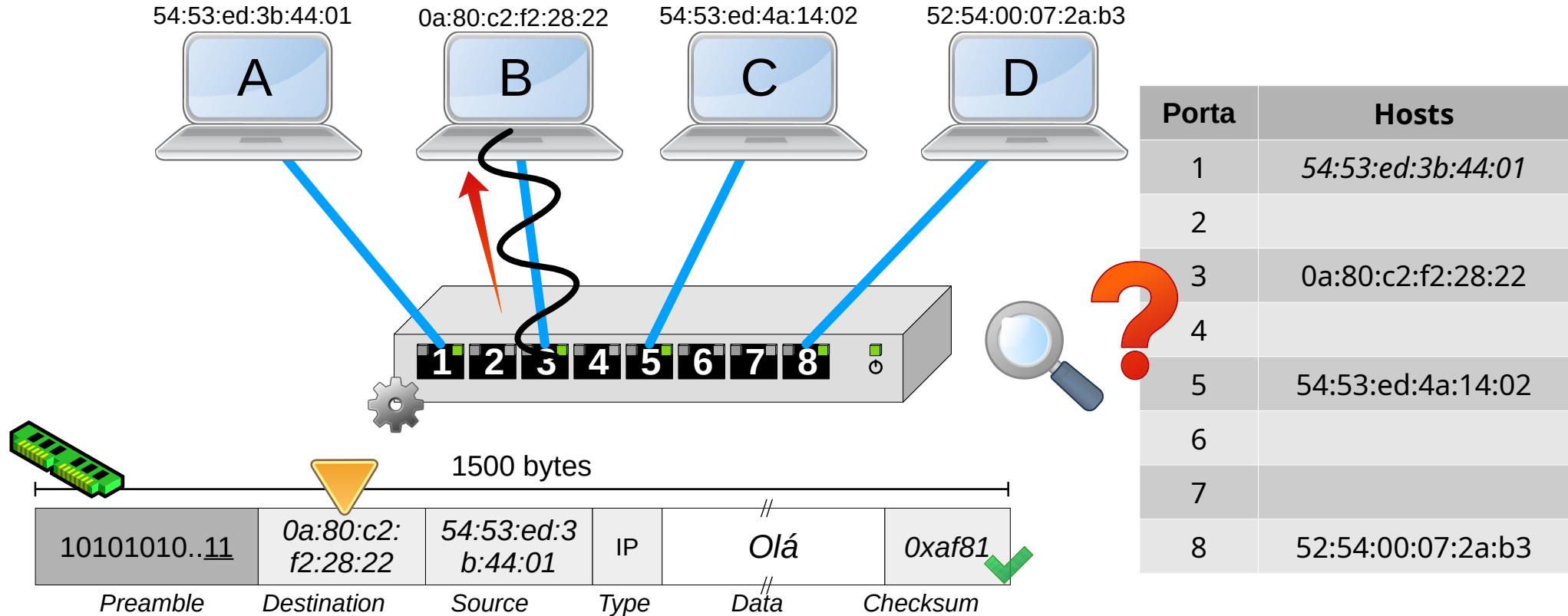
Switching

Há alguns tipos de comutação: ***Store and forward***



Switching

Há alguns tipos de comutação: ***Store and forward***



Switching

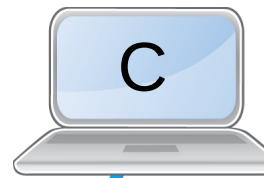
Há alguns tipos de comutação: ***Store and forward***



A



B



C



D

54:53:ed:3b:44:01

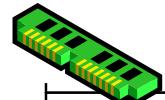
0a:80:c2:f2:28:22

54:53:ed:4a:14:02

52:54:00:07:2a:b3

Porta	Hosts
1	54:53:ed:3b:44:01
2	0a:80:c2:f2:28:22
6	54:53:ed:4a:14:02
7	
8	52:54:00:07:2a:b3

Esse é o método mais confiável e todavia mais lento!



1500 bytes

10101010..110a:80:c2:
f2:28:2254:53:ed:3
b:44:01

IP

Olá

0xaf81

Preamble

Destination

Source

Type

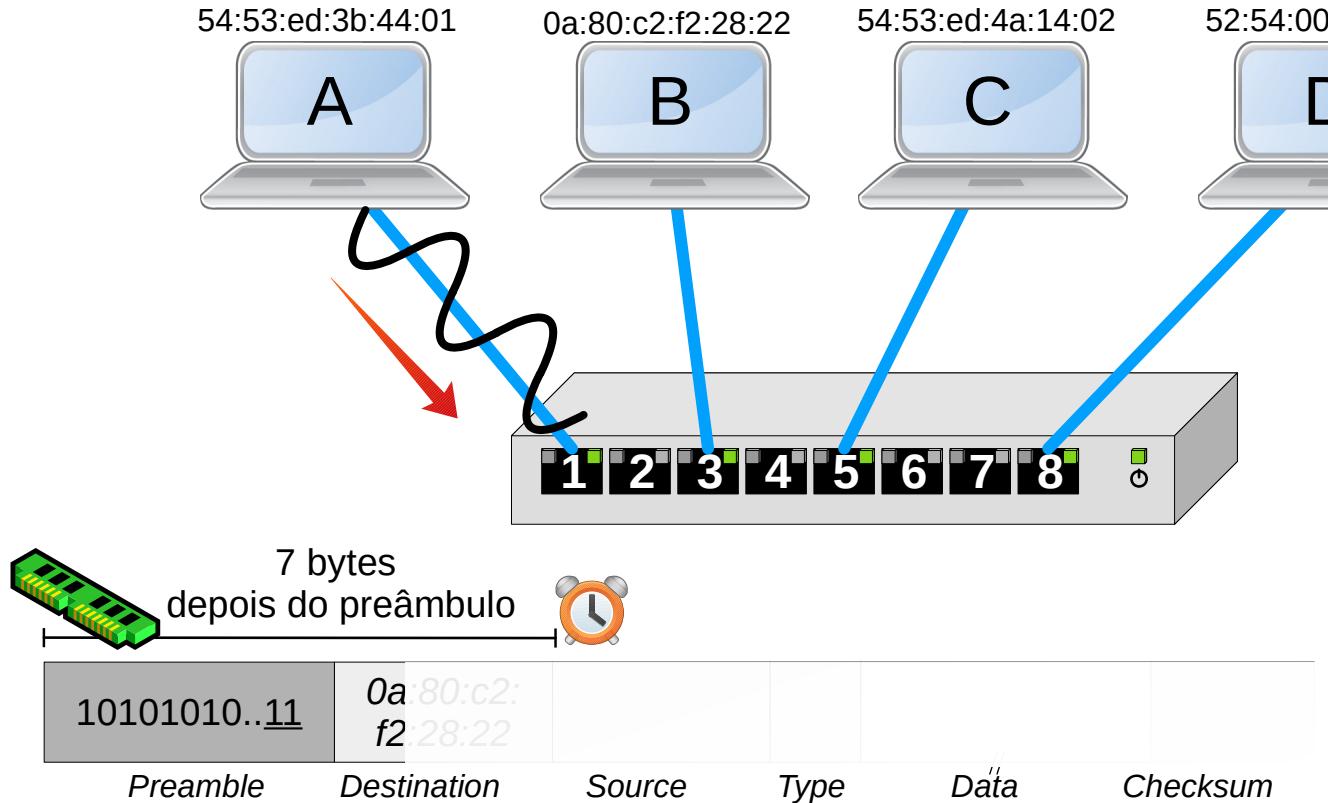
Data

Checksum



Switching

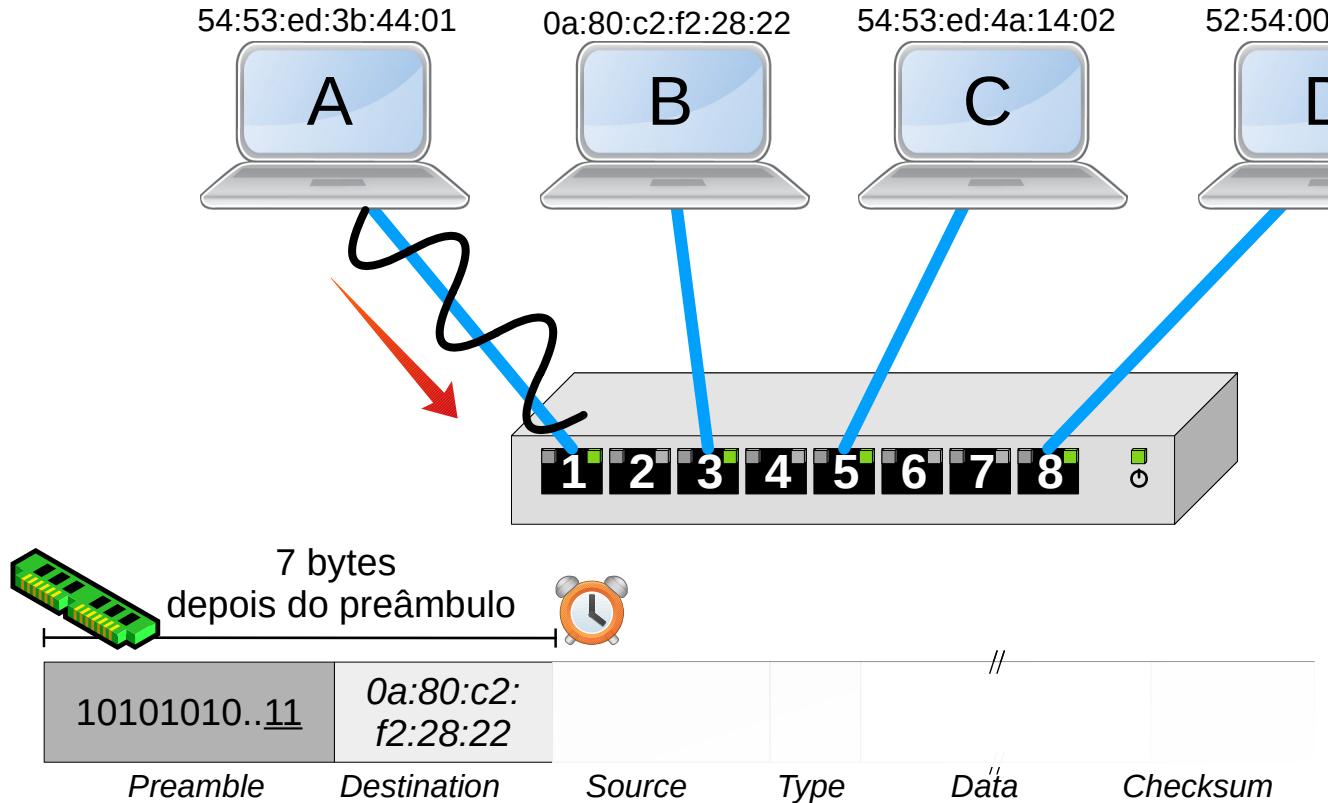
Há alguns tipos de comutação: **Cut-through**



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	0a:80:c2:f2:28:22
4	
5	54:53:ed:4a:14:02
6	
7	
8	52:54:00:07:2a:b3

Switching

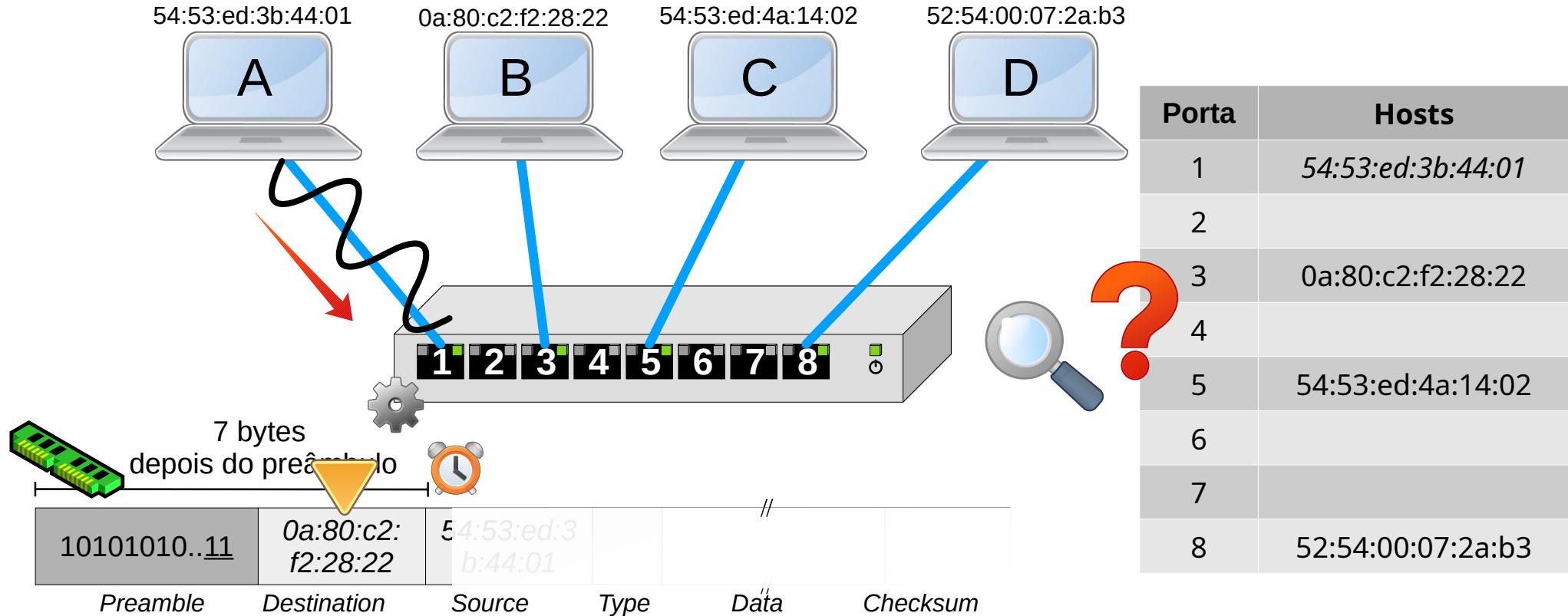
Há alguns tipos de comutação: **Cut-through**



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	0a:80:c2:f2:28:22
4	
5	54:53:ed:4a:14:02
6	
7	
8	52:54:00:07:2a:b3

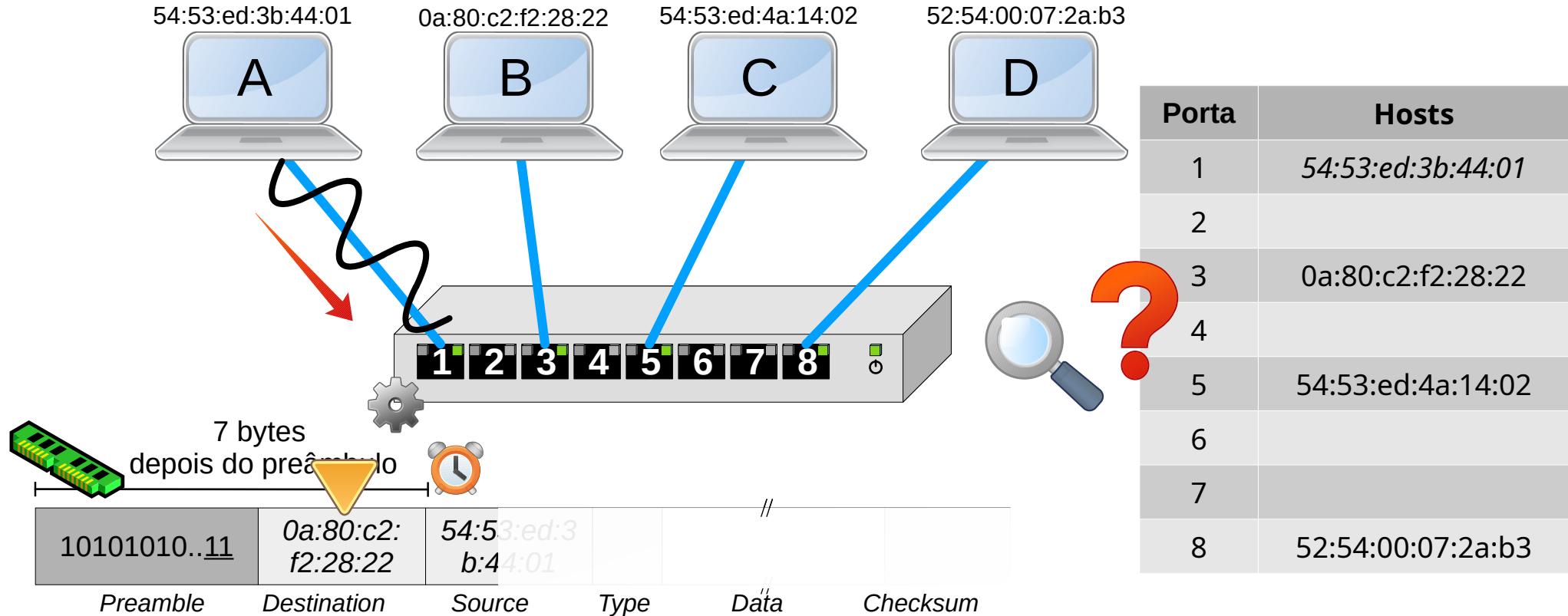
Switching

Há alguns tipos de comutação: **Cut-through**



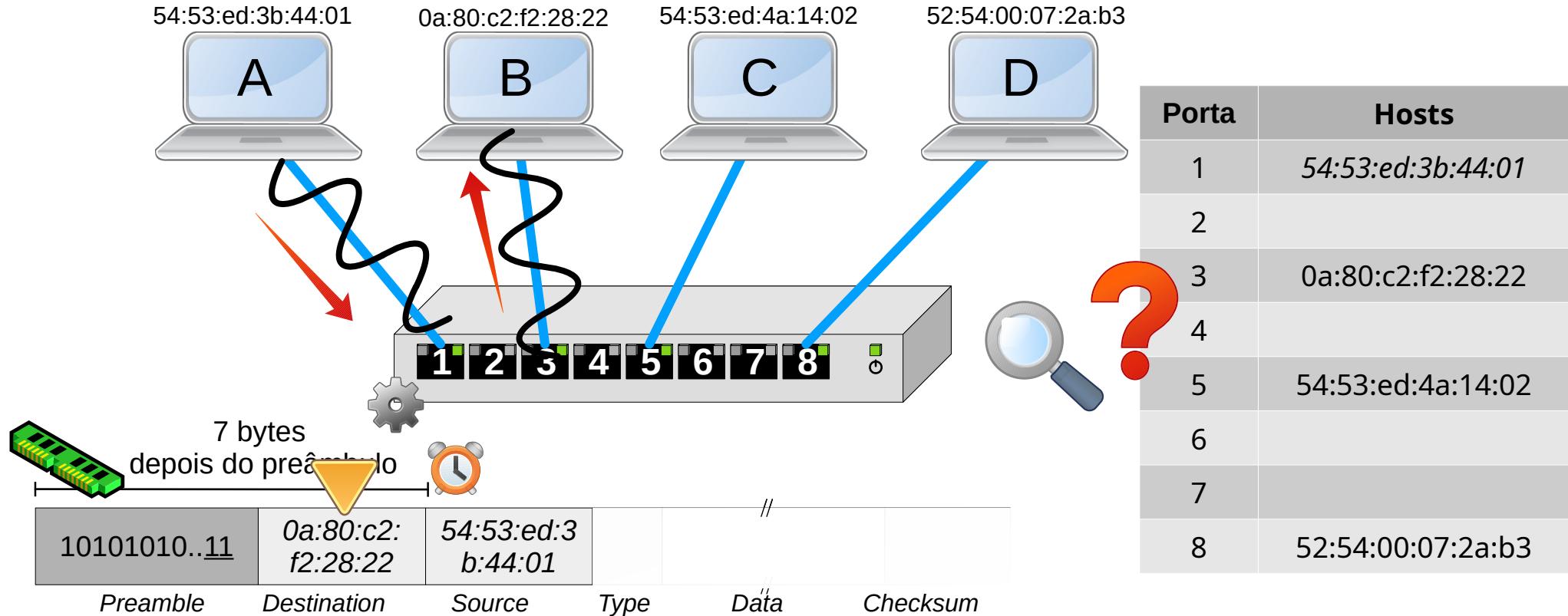
Switching

Há alguns tipos de comutação: **Cut-through**



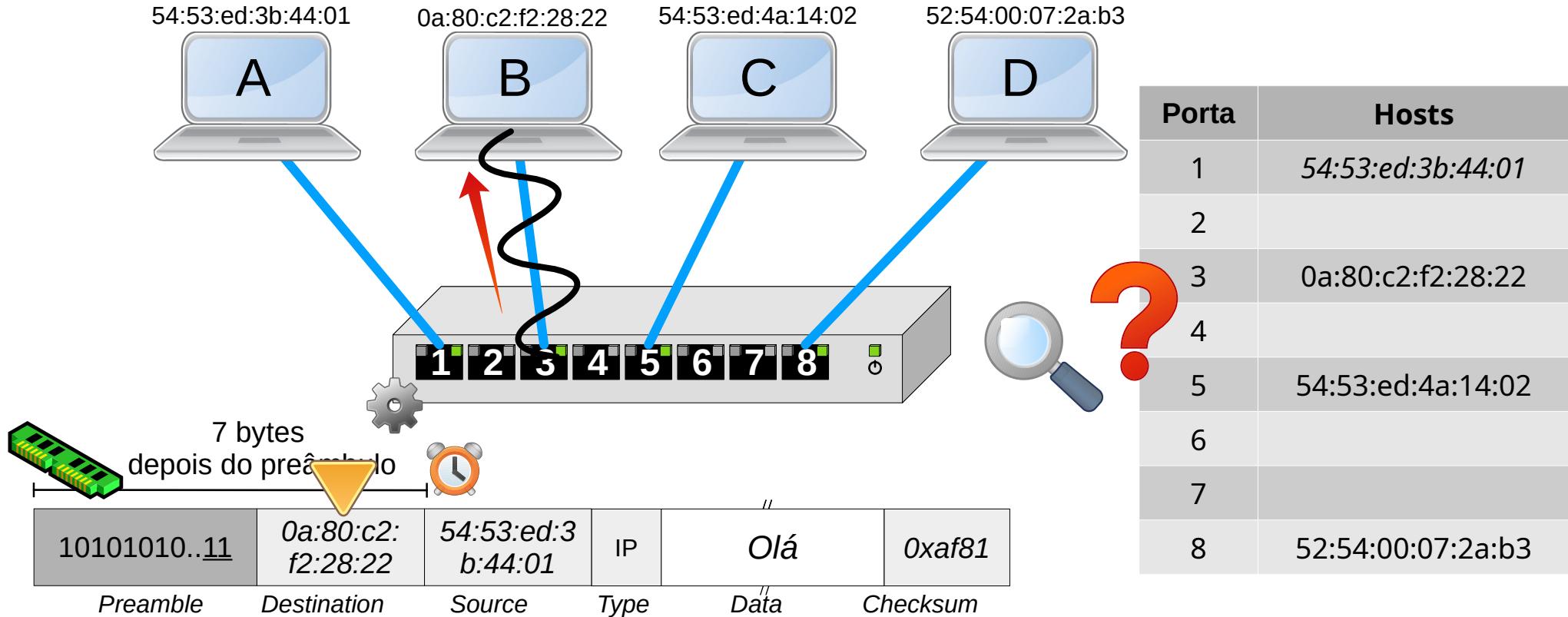
Switching

Há alguns tipos de comutação: **Cut-through**



Switching

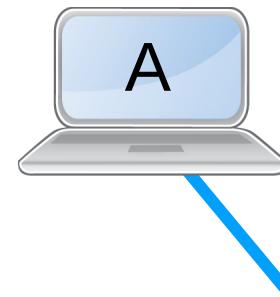
Há alguns tipos de comutação: **Cut-through**



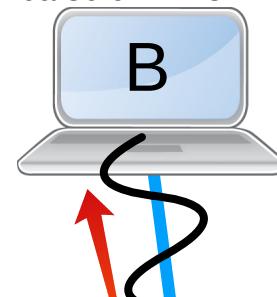
Switching

Há alguns tipos de comutação: **Cut-through**

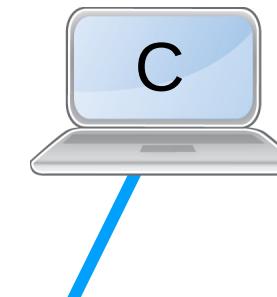
54:53:ed:3b:44:01



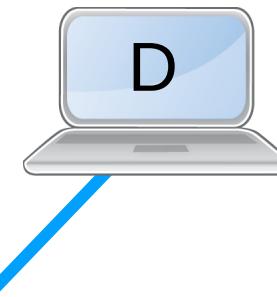
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



52:54:00:07:2a:b3

**Porta****Hosts**

1

54:53:ed:3b:44:01

2

0a:80:c2:f2:28:22

6

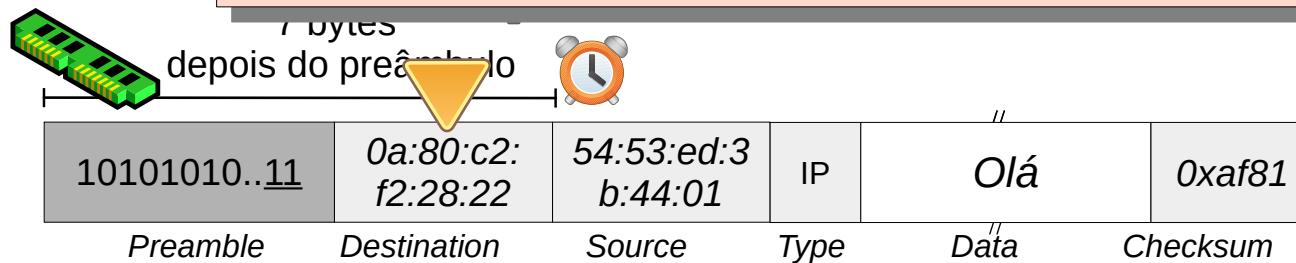
54:53:ed:4a:14:02

7

8

52:54:00:07:2a:b3

Esse é o método mais rápido e todavia mais suscetível a erros !



Switching

Há alguns tipos de comutação: ***FragmentFree***

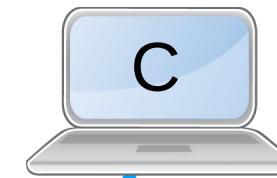
54:53:ed:3b:44:01



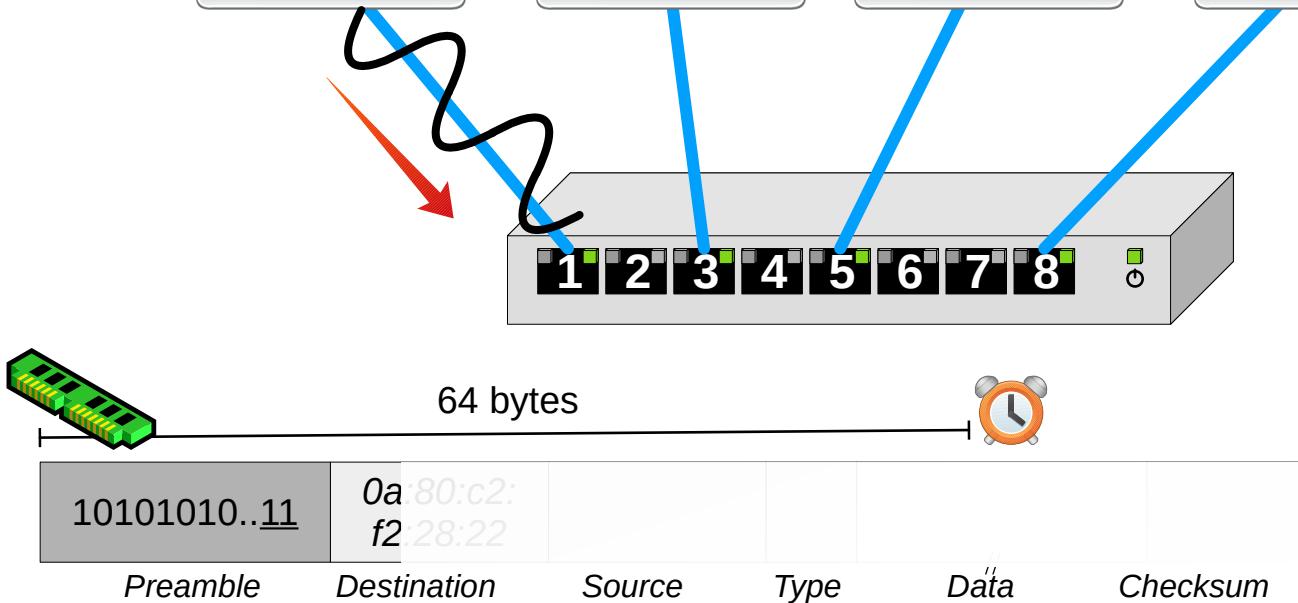
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



52:54:00:07:2a:b3



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	0a:80:c2:f2:28:22
4	
5	54:53:ed:4a:14:02
6	
7	
8	52:54:00:07:2a:b3

Switching

Há alguns tipos de comutação: ***FragmentFree***

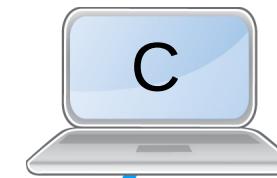
54:53:ed:3b:44:01



0a:80:c2:f2:28:22



54:53:ed:4a:14:02



52:54:00:07:2a:b3

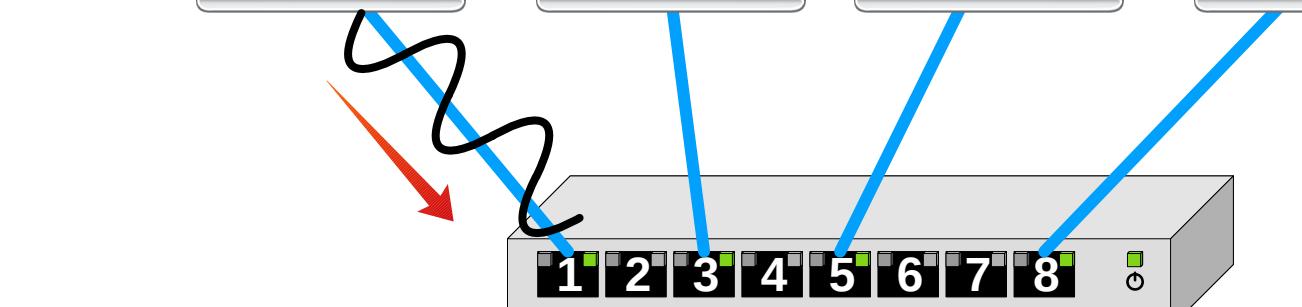


A

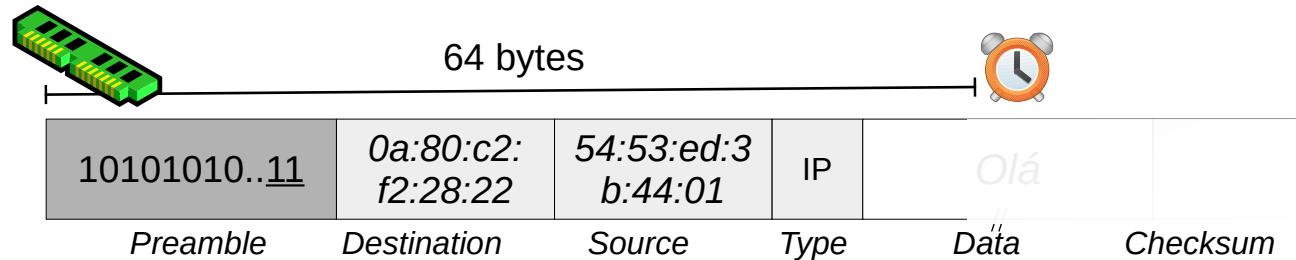
B

C

D



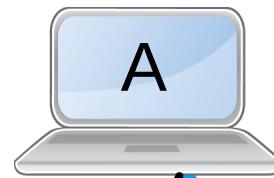
64 bytes



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	0a:80:c2:f2:28:22
4	
5	54:53:ed:4a:14:02
6	
7	
8	52:54:00:07:2a:b3

Switching

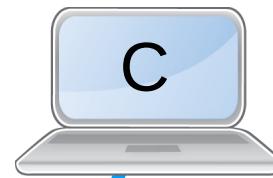
Há alguns tipos de comutação: ***FragmentFree***



54:53:ed:3b:44:01



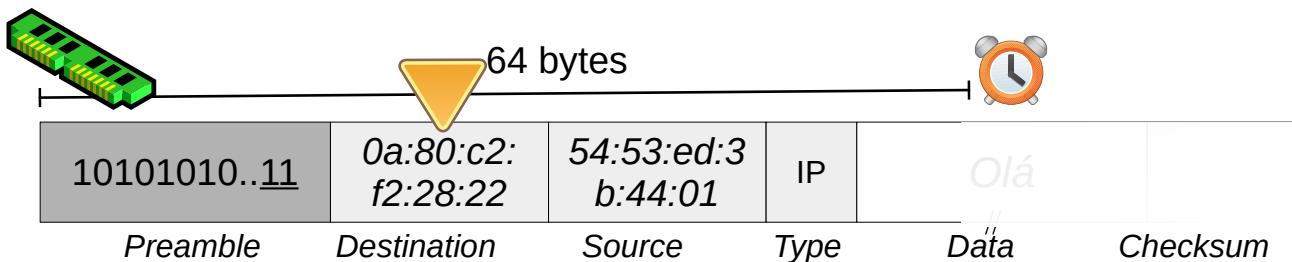
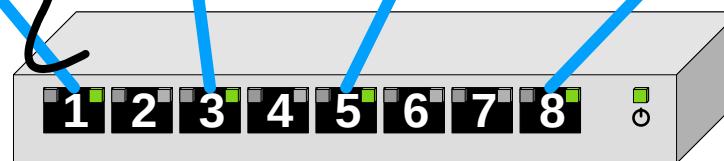
0a:80:c2:f2:28:22



54:53:ed:4a:14:02



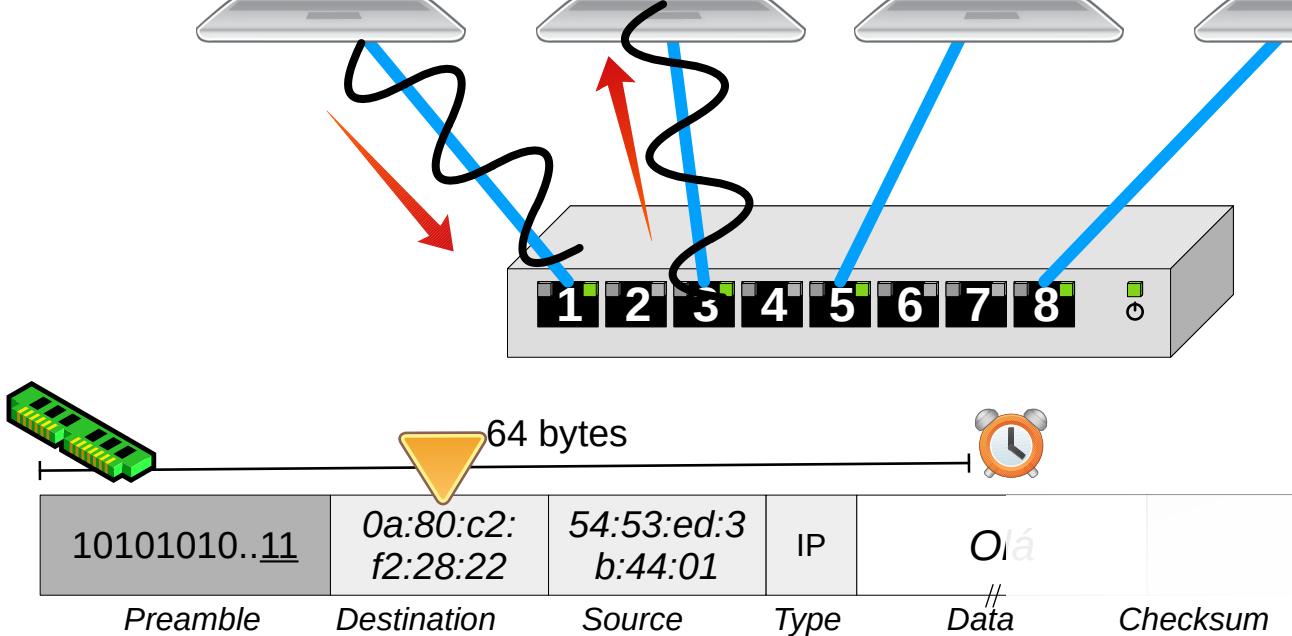
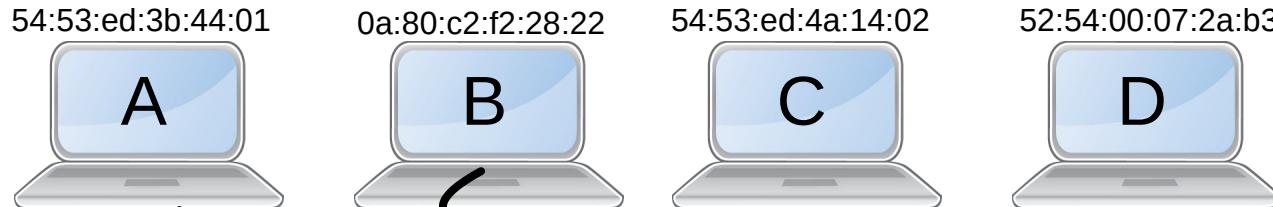
52:54:00:07:2a:b3



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	0a:80:c2:f2:28:22
4	
5	54:53:ed:4a:14:02
6	
7	
8	52:54:00:07:2a:b3

Switching

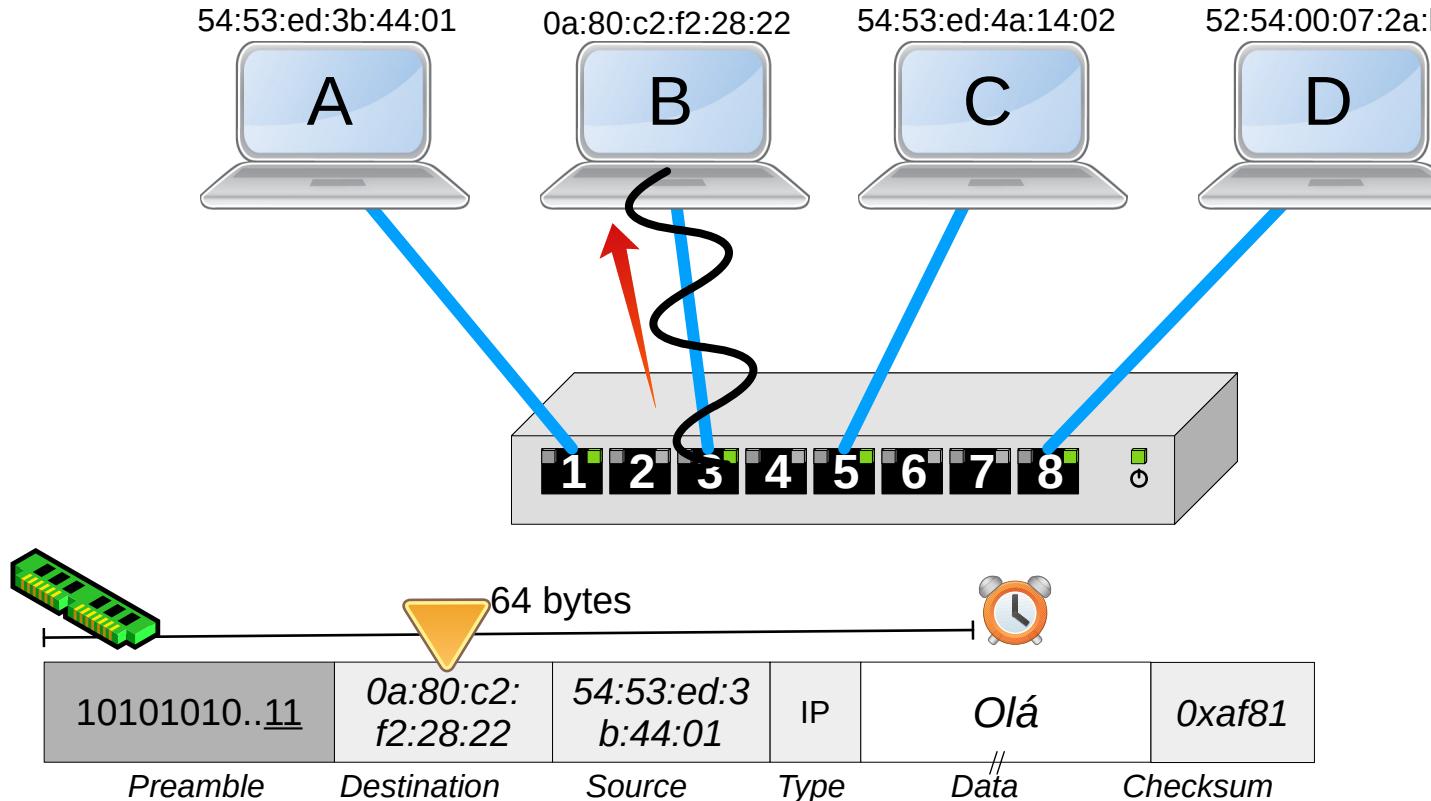
Há alguns tipos de comutação: ***FragmentFree***



Porta	Hosts
1	54:53:ed:3b:44:01
2	
3	0a:80:c2:f2:28:22
4	
5	54:53:ed:4a:14:02
6	
7	
8	52:54:00:07:2a:b3

Switching

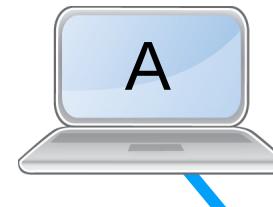
Há alguns tipos de comutação: ***FragmentFree***



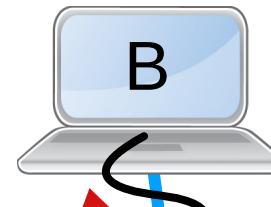
Switching

Há alguns tipos de comutação: ***FragmentFree***

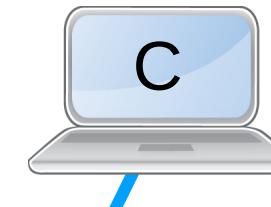
54:53:ed:3b:44:01



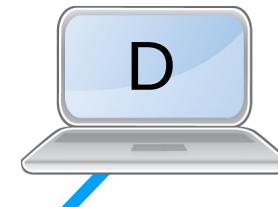
0a:80:c2:f2:28:22



54:53:ed:4a:14:02

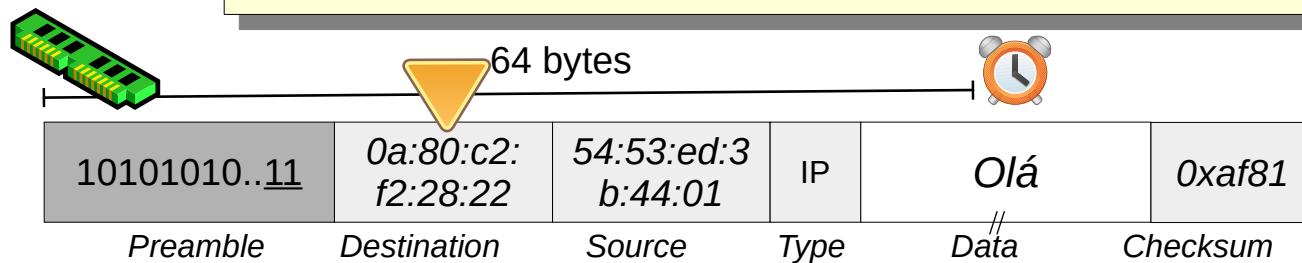


52:54:00:07:2a:b3



Porta	Hosts
1	54:53:ed:3b:44:01
2	0a:80:c2:f2:28:22
3	54:53:ed:4a:14:02
4	52:54:00:07:2a:b3

Esse é um método intermediário: não tão lento quanto o *Store and Forward*, nem tão inseguro quanto o *Cut-through*!



Switching

Qual o melhor método de comutação?



Switching

Qual o melhor método de comutação?



Depende...

Switching

Cut-through



10101010.. <u>11</u>	0a:80:c2: f2:28:22	54:53:ed:3 b:44:01	IP	Olá //	0xaf81
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FragmentFree



10101010.. <u>11</u>	0a:80:c2: f2:28:22	54:53:ed:3 b:44:01	IP	Olá //	0xaf81
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Store and Forward



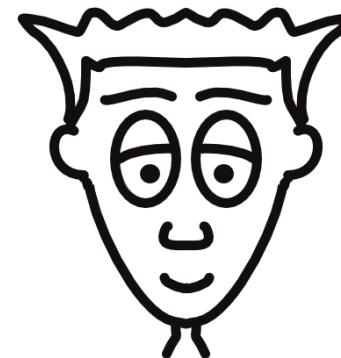
Preamble	Destination	Source	Type	Data //	Checksum
10101010.. <u>11</u>	0a:80:c2: f2:28:22	54:53:ed:3 b:44:01	IP	Olá	0xaf81

Switching

Conclusão:

Switching foi uma grande evolução nas redes de computadores.

Mesmo com o problema dos *loops* (resolvido com o STP), vale muito a pena utilizar *switches*, já que esse fornece segurança e velocidade para as redes.



Obrigado!!!

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<https://luizsantos.github.io/>

Links e referencias na descrição do vídeo