

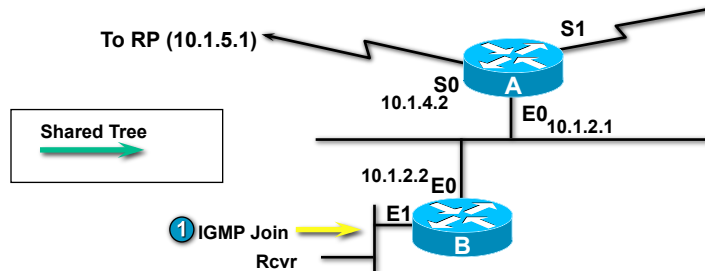
PIM ASM Details



PIM SM Joining



PIM SM Joining

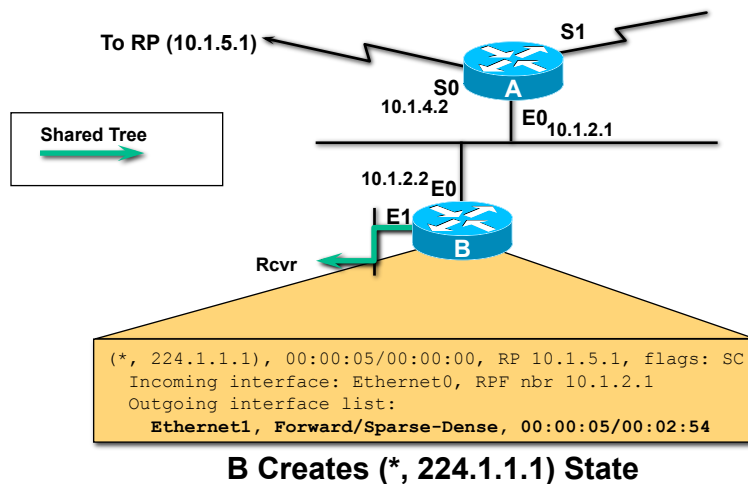


- ① Rcvr wishes to receive group G traffic. Sends IGMP Join for G.

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3

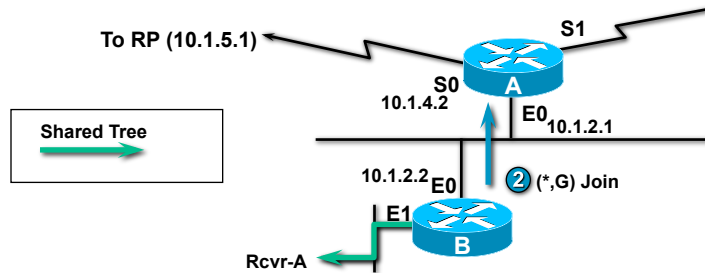
PIM SM Joining



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PIM SM Joining

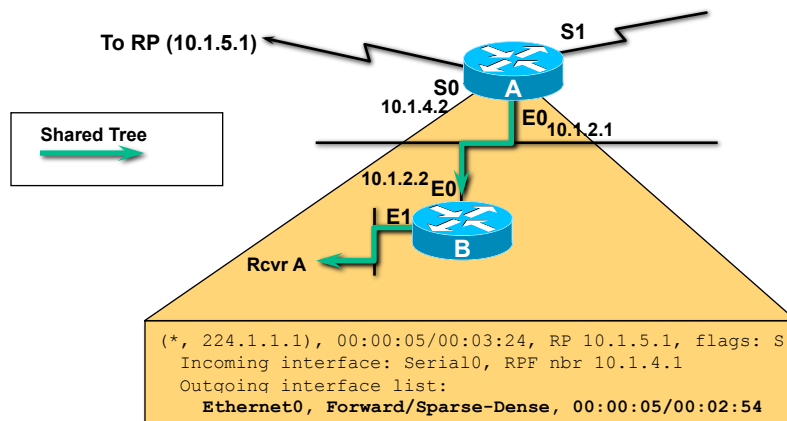


- ① Rcvr wishes to receive group G traffic. Sends IGMP Join for G.
- ② B sends (*,G) Join towards RP.

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PIM SM Joining

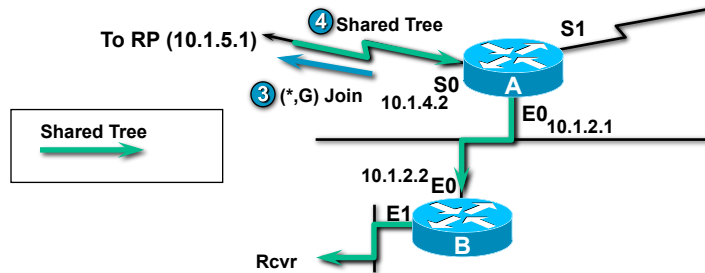


A Creates (*, 224.1.1.1) State

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PIM SM Joining



- ① Rcvr wishes to receive group G traffic. Sends IGMP Join for G.
- ② B sends (*,G) Join towards RP.
- ③ A sends (*,G) Join towards RP.
- ④ Shared tree is built all the way back to the RP.

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PIM SM Pruning

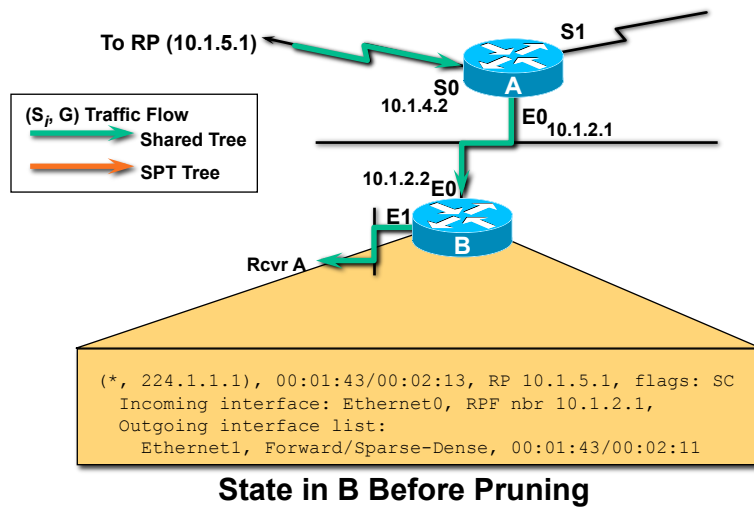


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PIM SM Pruning

Shared Tree Case

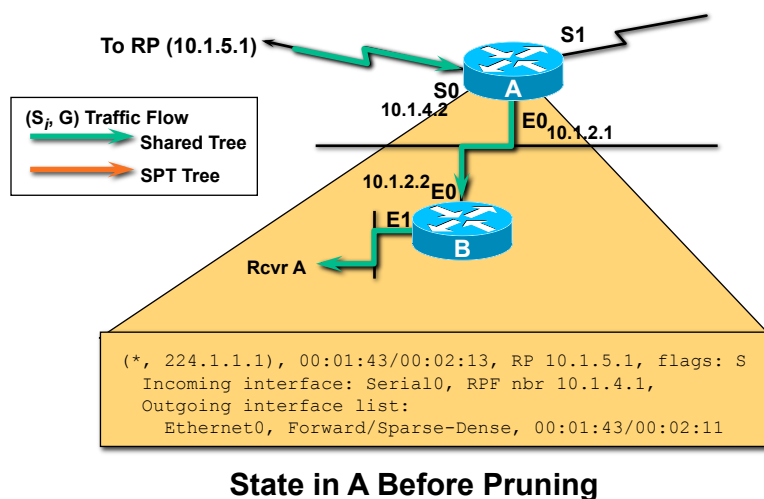


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PIM SM Pruning

Shared Tree Case

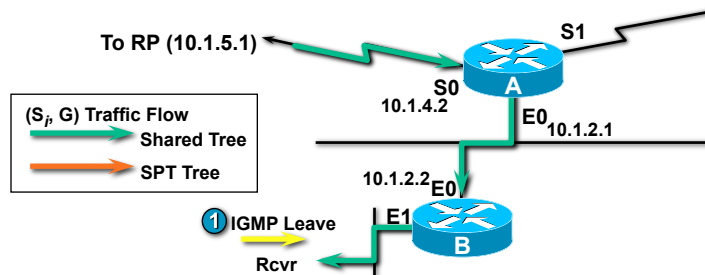


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10

PIM SM Pruning

Shared Tree Case



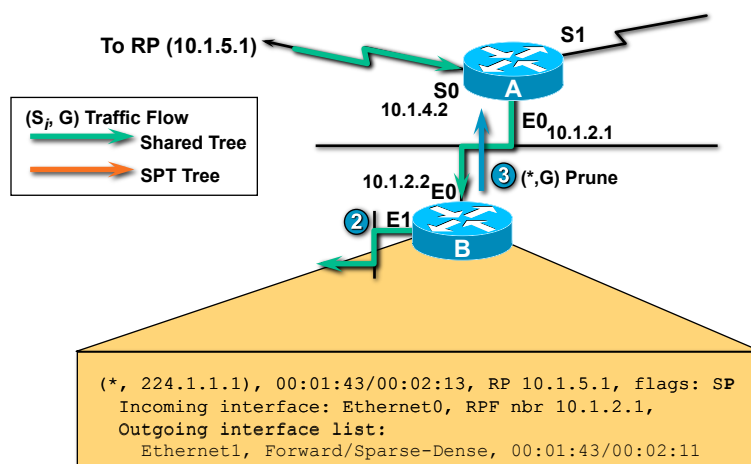
- 1 B is a Leaf router. Last Rcvr, leaves group G.

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PIM SM Pruning

Shared Tree Case



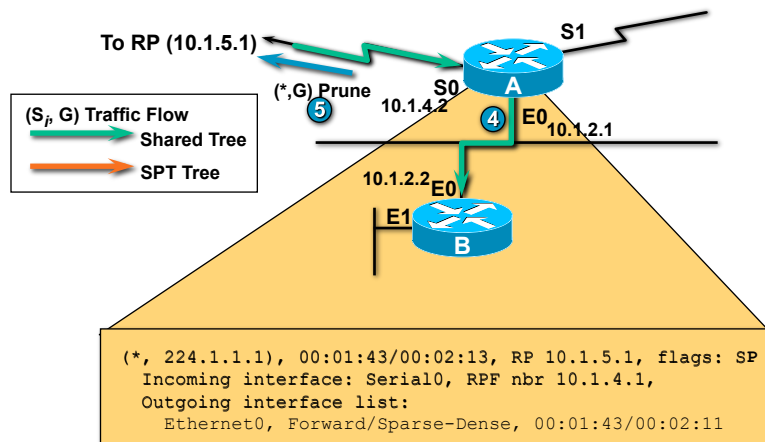
- 2 B removes E1 from (*,G) and any (S, G) "oilists".
- 3 B's (*,G) "oilist" now empty; triggers (*,G) Prune toward RP.

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PIM SM Pruning

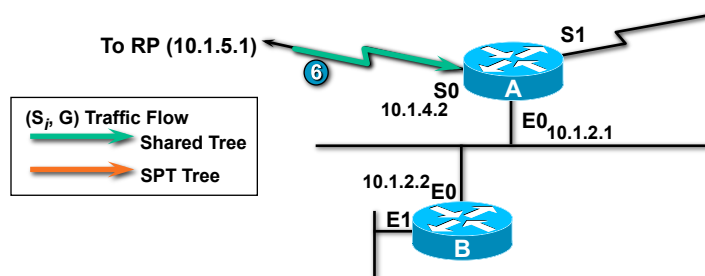
Shared Tree Case



- 4 A receives Prune; removes E0 from (*,G) "oilist".
(After the 3 second Multi-access Network Prune delay.)
- 5 A's (*,G) "oilist" now empty; triggers (*,G) Prune toward RP.

PIM SM Pruning

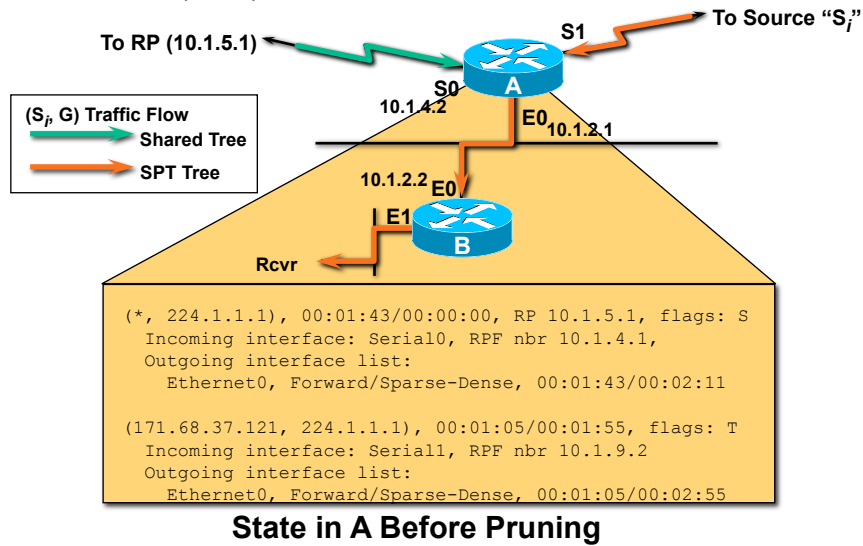
Shared Tree Case



- 6 Pruning continues back toward RP.**

PIM SM Pruning

Source (SPT) Case



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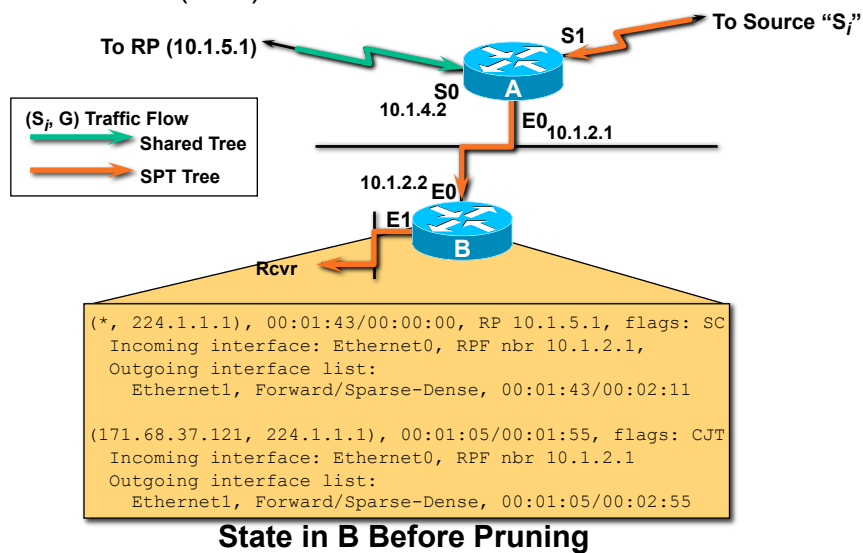
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PIM SM Pruning

Source (SPT) Case



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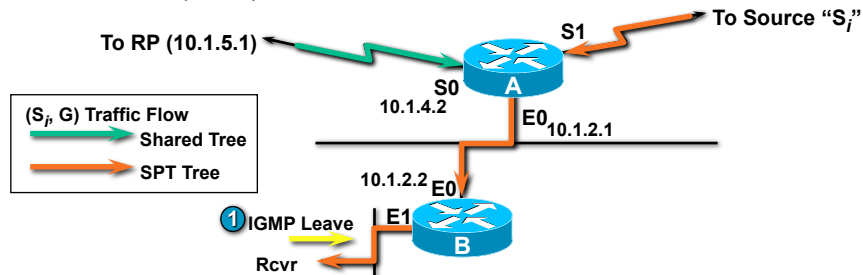
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PIM SM Pruning

Source (SPT) Case

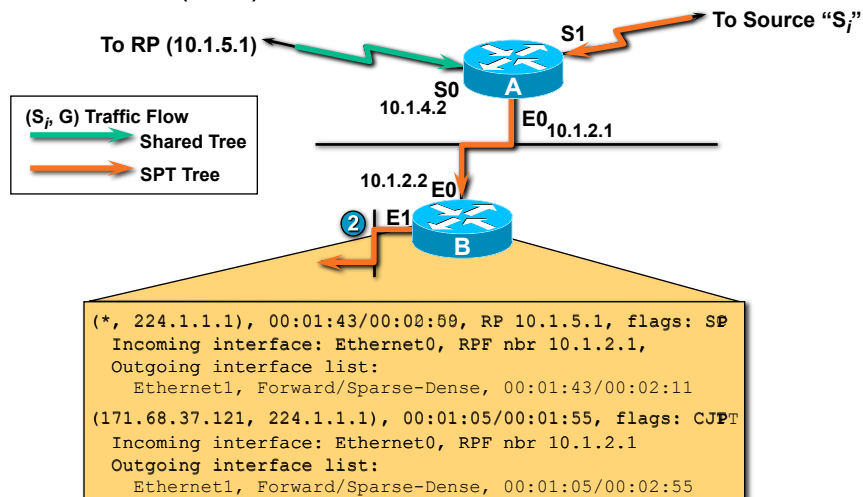


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PIM SM Pruning

Source (SPT) Case

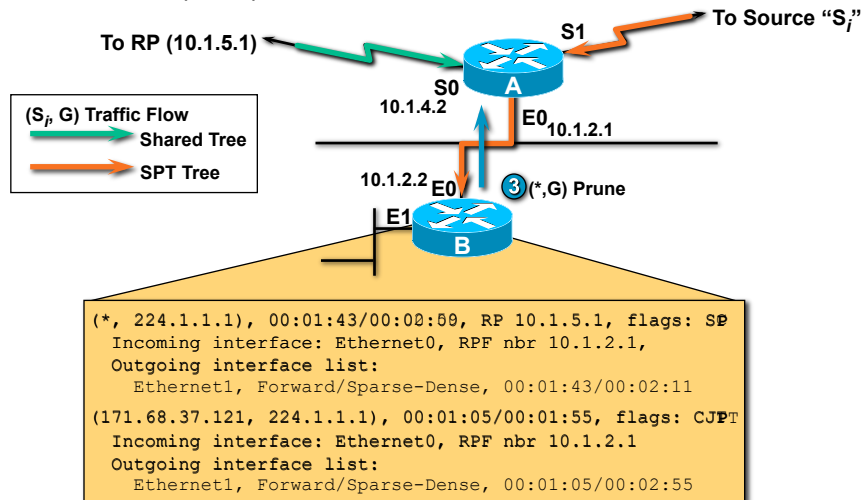


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PIM SM Pruning

Source (SPT) Case



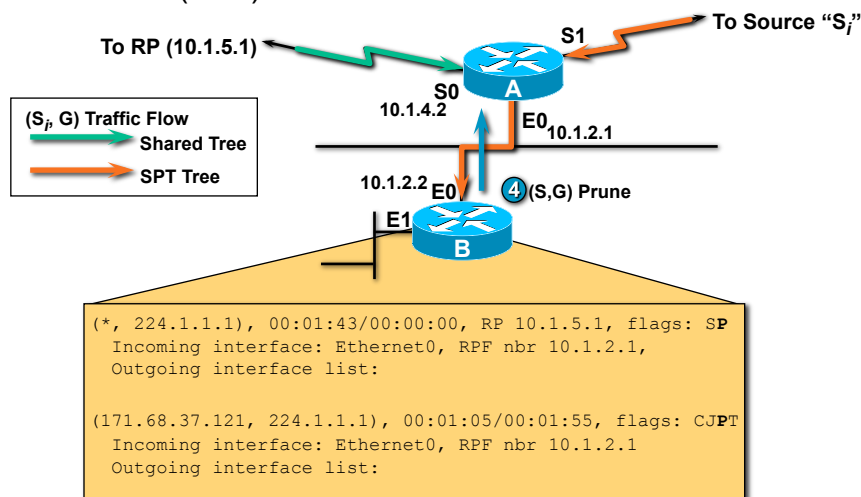
③ B's (*,G) OIL now empty; triggers (*,G) Prune toward RP.

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PIM SM Pruning

Source (SPT) Case



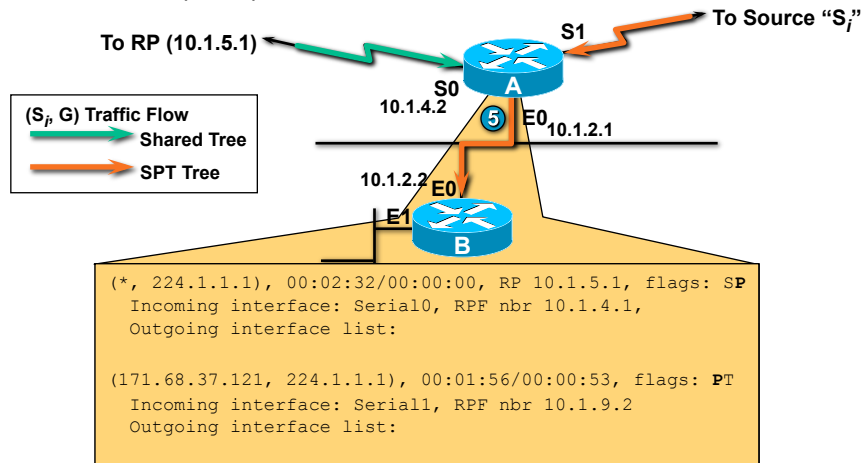
④ B's (S,G) OIL also now empty; triggers (S, G) Prune towards Si.

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PIM SM Pruning

Source (SPT) Case



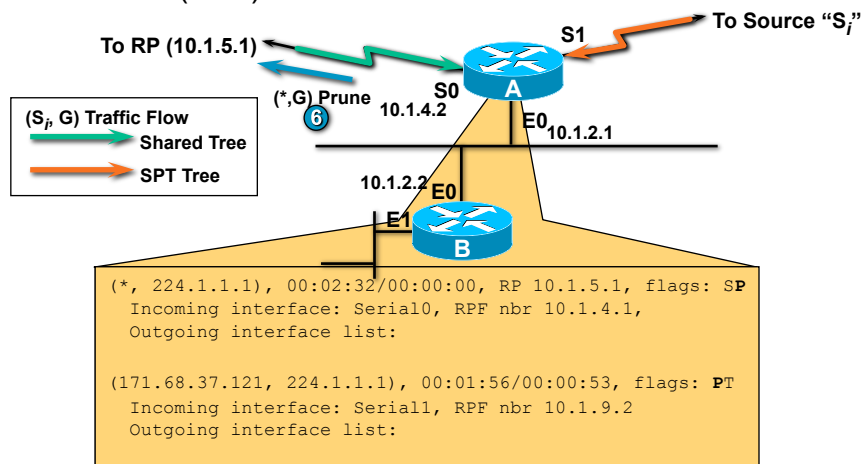
- ⑤ A receives (*, G) Prune; removes E0 from (*,G) & (S,G) OIL's
(After the 3 second Multi-access Network Prune delay.)

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PIM SM Pruning

Source (SPT) Case



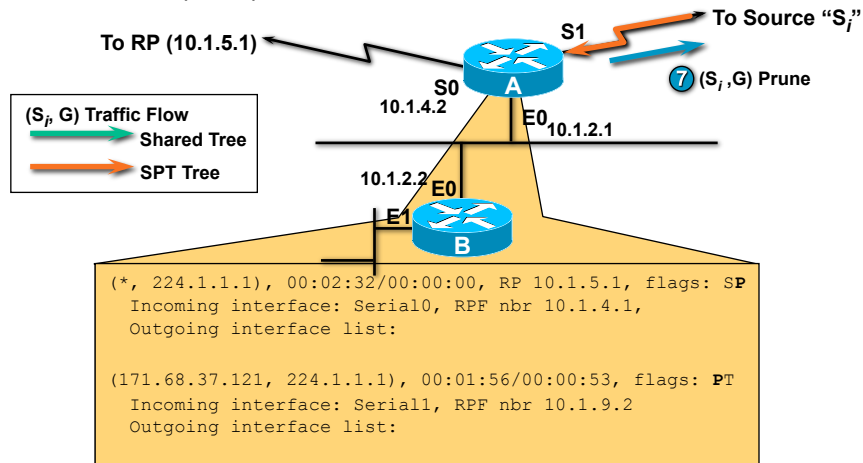
- ⑥ A's (*,G) OIL now empty; triggers (*,G) Prune toward RP.

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PIM SM Pruning

Source (SPT) Case

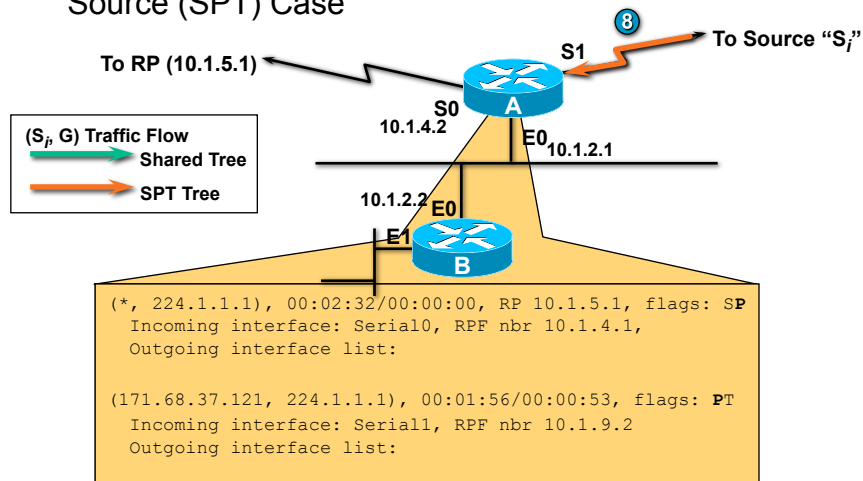


7 A's (S_i, G) OIL also now empty; triggers (S_i, G) Prune towards S_i.

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PIM SM Pruning

Source (SPT) Case



8 (S_i, G) traffic ceases flowing down SPT.

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PIM SM Registering



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PIM SM Registering— Receiver Joins First

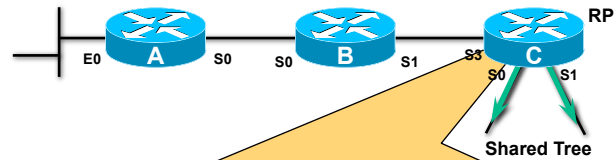


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PIM SM Registering

Receiver Joins Group First



```
(*, 224.1.1.1), 00:03:14/00:02:59, RP 171.68.28.140, flags:S
Incoming interface: Null, RPF nbr 0.0.0.0,
Outgoing interface list:
  Serial0, Forward/Sparse-Dense, 00:03:14/00:03:15
  Serial1, Forward/Sparse-Dense, 00:03:14/00:03:15
```

State in "RP" Before Any Source Registers
(With Receivers on Shared Tree)

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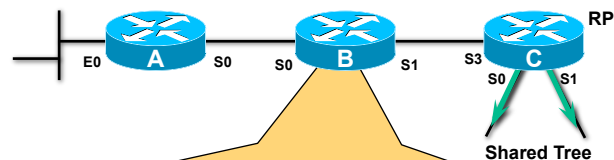
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PIM SM Registering

Receiver Joins Group First



```
rtr-b>sh ip mroute 224.1.1.1
```

```
No such group
```

State in B Before Any Source Registers
(With Receivers on Shared Tree)

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14988_04_2008.ct

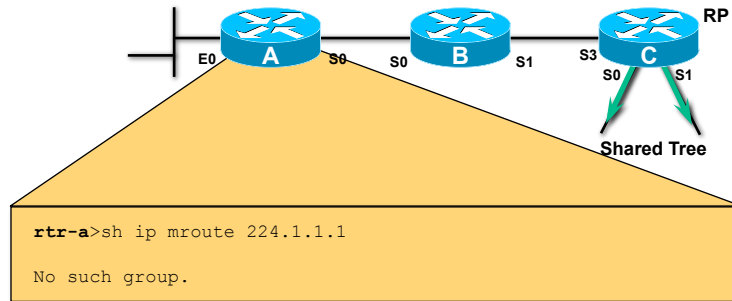
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PIM SM Registering

Receiver Joins Group First



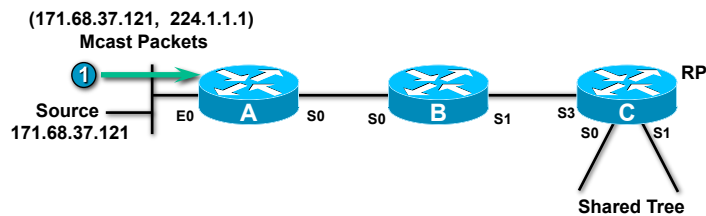
State in A Before Any Source Registers
(With Receivers on Shared Tree)

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PIM SM Registering

Receiver Joins Group First

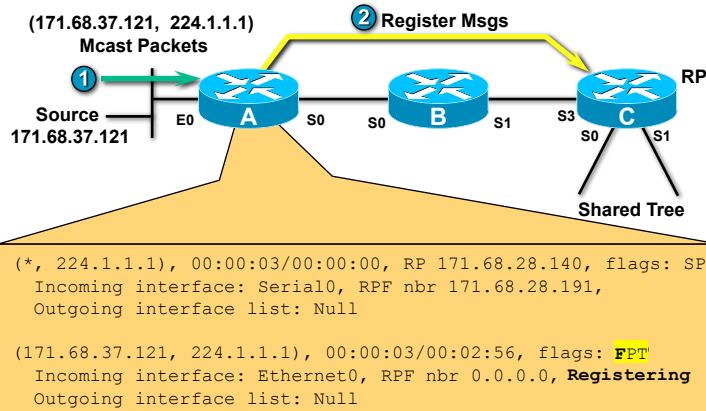


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PIM SM Registering

Receiver Joins Group First



A Creates (S, G) State for Source
(After Automatically Creating a (*, G) entry)

- ① Source begins sending group G traffic.
- ② A encapsulates packets in Registers; unicasts to RP.

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14888_04_2008.ct

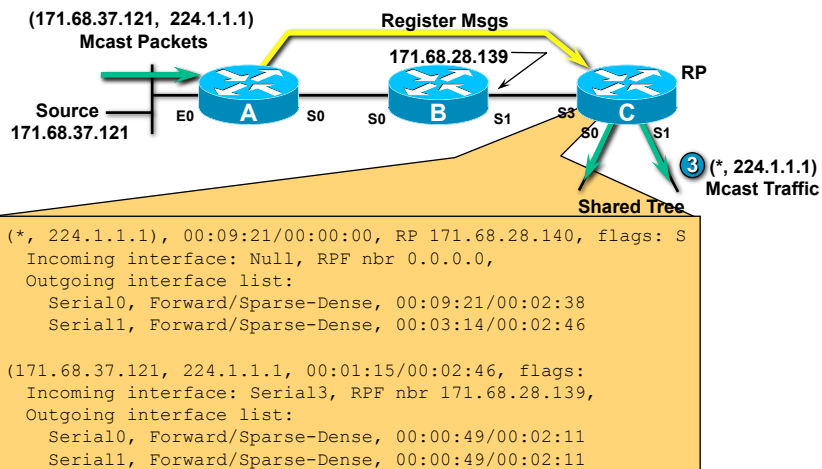
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PIM SM Registering

Receiver Joins Group First



“RP” Processes Register; Creates (S, G) State

- ③ RP (C) de-encapsulates packets; forwards down Shared tree.

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14888_04_2008.ct

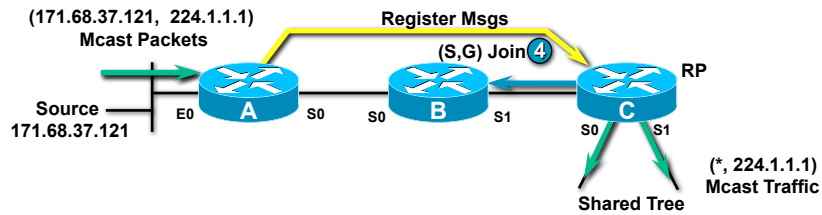
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PIM SM Registering

Receiver Joins Group First



④ RP sends (S,G) Join toward Source to build SPT.

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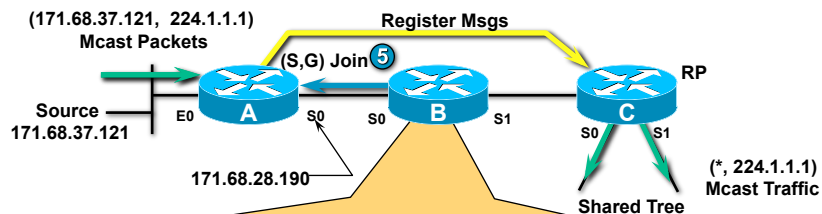
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PIM SM Registering

Receiver Joins Group First



```
(*, 224.1.1.1), 00:04:28/00:00:00, RP 171.68.28.140, flags: SP
Incoming interface: Serial11, RPF nbr 171.68.28.140,
Outgoing interface list: Null
```

```
(171.68.37.121, 224.1.1.1), 00:04:28/00:01:32, flags:
Incoming interface: Serial0, RPF nbr 171.68.28.190
Outgoing interface list:
Serial11, Forward/Sparse-Dense, 00:04:28/00:01:32
```

B Processes Join, Creates (S, G) State
(After Automatically Creating the (*, G) Entry)

⑤ B sends (S,G) Join toward Source to continue building SPT.

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14588_04_2008_c1

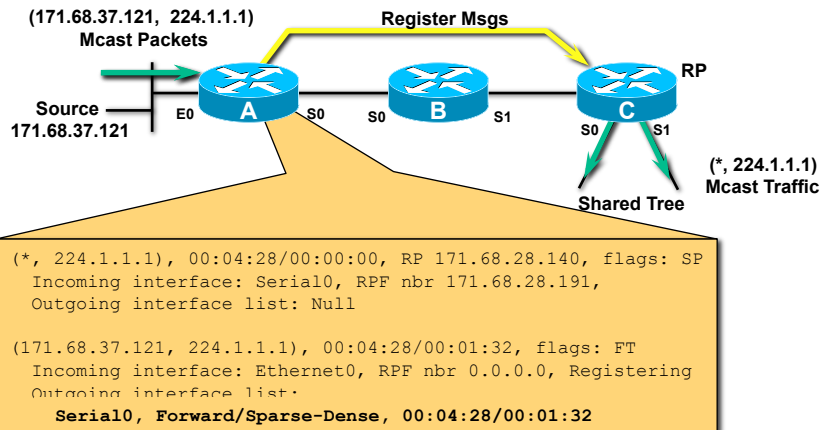
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PIM SM Registering

Receiver Joins Group First



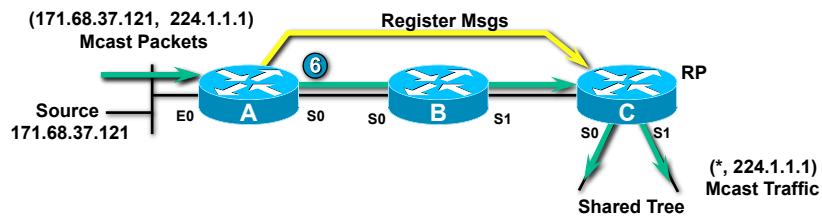
A Processes the (S, G) Join; Adds Serial0 to OIL

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PIM SM Registering

Receiver Joins Group First



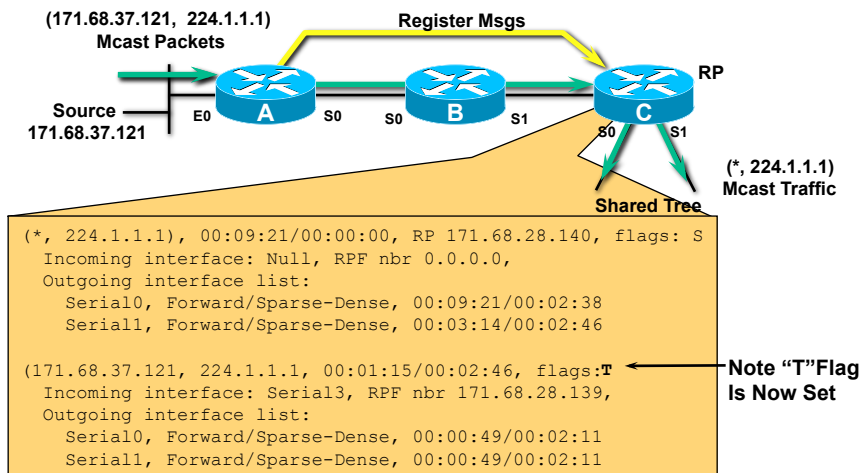
⑥ RP begins receiving (S,G) traffic down SPT.

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PIM SM Registering

Receiver Joins Group First



**Traffic Arriving via SPT Is Forwarded Down Shared Tree
(This Causes the "T" Flag to Be Set)**

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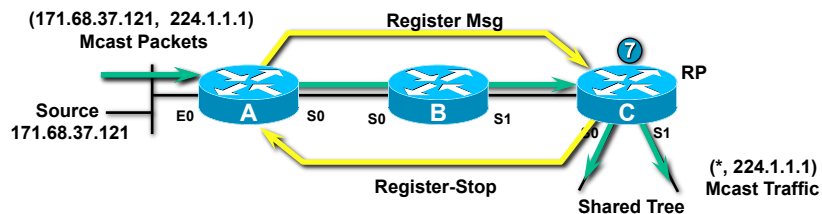
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PIM SM Registering

Receiver Joins Group First



- ⑦ Once "T" Flag is set, next "Register" causes RP to send back a "Register-Stop" to A

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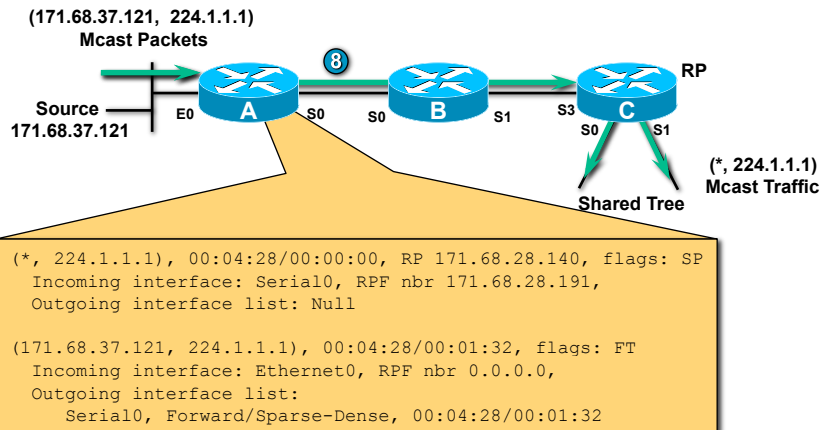
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PIM SM Registering

Receiver Joins Group First



A Stops Sending Register Messages

(Final State in A)

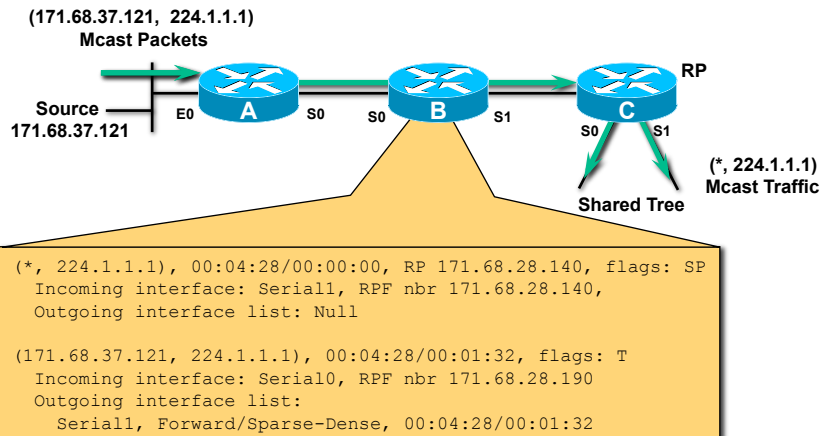
⑧ (S,G) Traffic now flowing down a single path (SPT) to RP.

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PIM SM Registering

Receiver Joins Group First



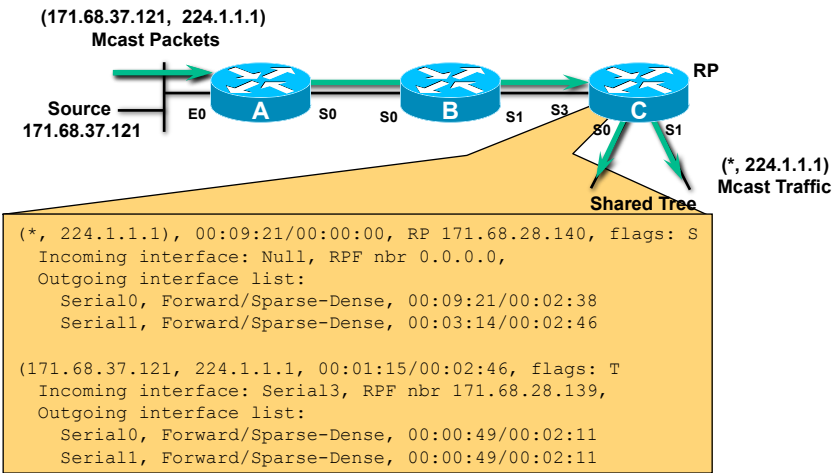
Final State in B

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PIM SM Registering

Receiver Joins Group First



Final State in the “RP”
(With Receivers on Shared Tree)

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PIM SM Registering— Source Registers First



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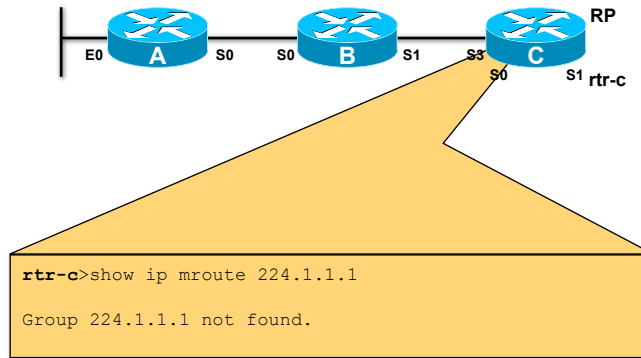
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PIM SM Registering

Source Registers First



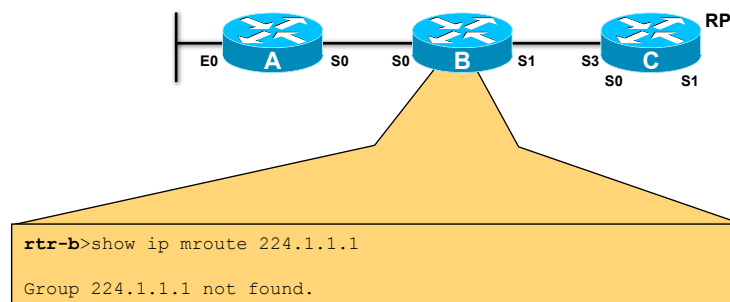
State in "RP" before Registering
(Without Receivers on Shared Tree)

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PIM SM Registering

Source Registers First



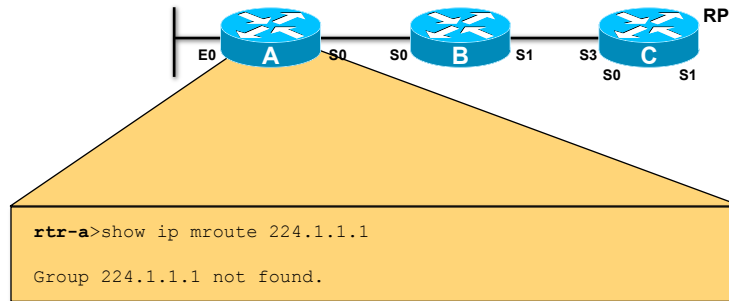
State in B Before Any Source Registers
(With Receivers on Shared Tree)

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44

PIM SM Registering

Source Registers First



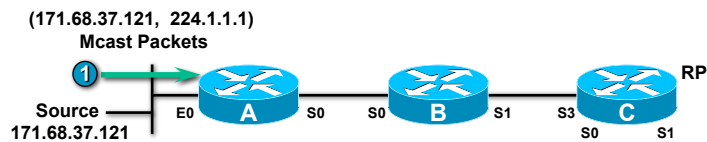
State in A Before Any Source Registers
(With Receivers on Shared Tree)

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45

PIM SM Registering

Source Registers First



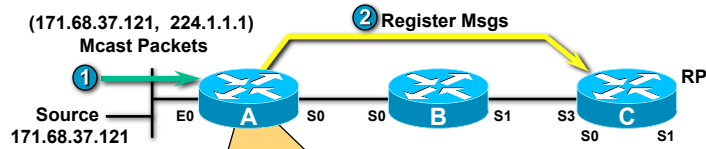
① Source begins sending group G traffic.

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PIM SM Registering

Source Registers First



```
(*, 224.1.1.1), 00:00:03/00:00:00, RP 171.68.28.140, flags: SP
Incoming interface: Serial0, RPF nbr 171.68.28.191,
Outgoing interface list: Null

(171.68.37.121, 224.1.1.1), 00:00:03/00:02:56, flags: FPT
Incoming interface: Ethernet0, RPF nbr 0.0.0.0, Registering
Outgoing interface list: Null
```

A Creates (S, G) State for Source (After Automatically Creating a (*, G) Entry)

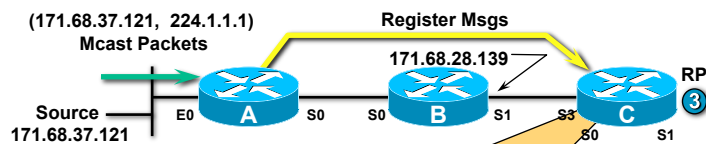
- ① Source begins sending group G traffic.
- ② A encapsulates packets in Registers; unicasts to RP.

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PIM SM Registering

Source Registers First



```
(*, 224.1.1.1), 00:01:15/00:00:00, RP 171.68.28.140, flags: SP
Incoming interface: Null, RPF nbr 0.0.0.0,
Outgoing interface list: Null

(171.68.37.121, 224.1.1.1), 00:01:15/00:01:45, flags: P
Incoming interface: Serial13, RPF nbr 171.68.28.139,
Outgoing interface list: Null
```

"RP" Processes Register; Creates (S, G) State (After Automatically Creating the (*, G) Entry)

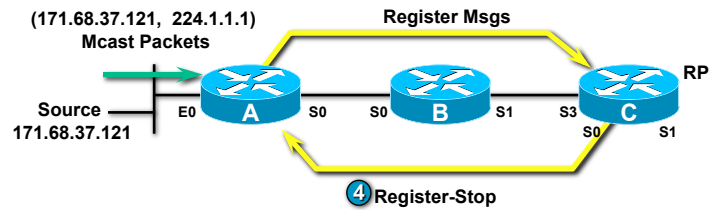
- ③ RP (C) has no receivers on Shared Tree; discards packet.

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PIM SM Registering

Source Registers First

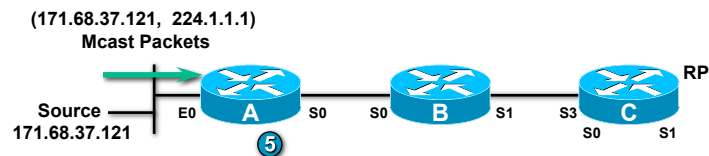


- ④ RP sends “Register-Stop” to A.

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PIM SM Registering

Source Registers First

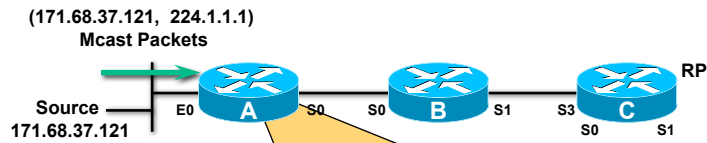


- ⑤ A stops encapsulating traffic in Register Messages; drops packets from Source.

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PIM SM Registering

Source Registers First



```
(*, 224.1.1.1), 00:01:28/00:00:00, RP 171.68.28.140, flags: SP
Incoming interface: Serial0, RPF nbr 171.68.28.191,
Outgoing interface list: Null

(171.68.37.121, 224.1.1.1), 00:01:28/00:01:32, flags: FPT
Incoming interface: Ethernet0, RPF nbr 0.0.0.0
Outgoing interface list: Null
```

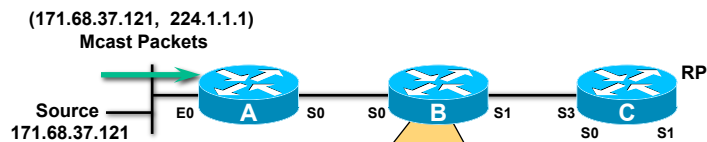
State in A After Registering (Without Receivers on Shared Tree)

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PIM SM Registering

Source Registers First



```
rtr-b>show ip mroute 224.1.1.1
Group 224.1.1.1 not found.
```

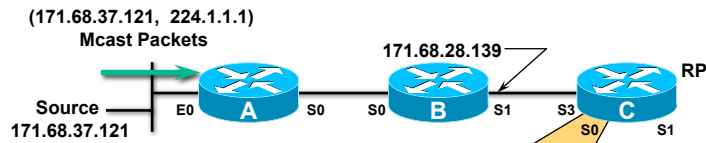
State in B after A Registers (Without Receivers on Shared Tree)

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PIM SM Registering

Source Registers First



```
(*, 224.1.1.1), 00:01:15/00:00:00, RP 171.68.28.140, flags: SP
Incoming interface: Null, RPF nbr 0.0.0.0,
Outgoing interface list: Null

(171.68.37.121, 224.1.1.1), 00:01:15/00:01:45, flags: P
Incoming interface: Serial13, RPF nbr 171.68.28.139,
Outgoing interface list: Null
```

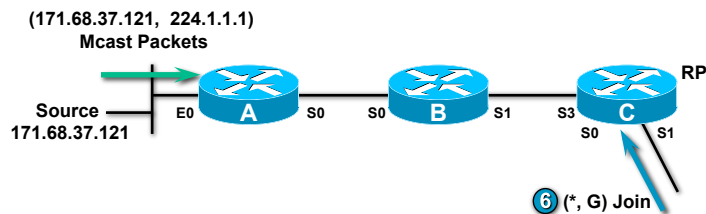
State in RP After A Registers (Without Receivers on Shared Tree)

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PIM SM Registering

Source Registers First



Receivers Begin Joining the Shared Tree

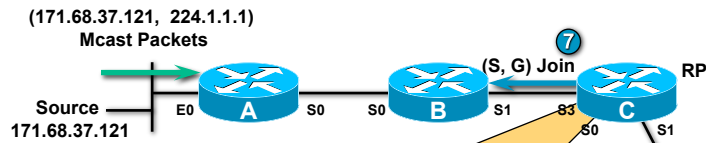
- 6 RP (C) receives (*, G) Join from a receiver on Shared Tree.

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PIM SM Registering

Source Registers First



```
(*, 224.1.1.1), 00:09:21/00:00:00, RP 171.68.28.140, flags: S
Incoming interface: Null, RPF nbr 0.0.0.0,
Outgoing interface list:
Serial1, Forward/Sparse-Dense, 00:00:14/00:02:46

(171.68.37.121, 224.1.1.1), 00:01:15/00:02:46, flags: T
Incoming interface: Serial3, RPF nbr 171.68.28.139,
Outgoing interface list:
Serial1, Forward/Sparse-Dense, 00:00:14/00:02:46
```

RP Processes (*,G) Join

(Adds Serial1 to Outgoing Interface Lists)

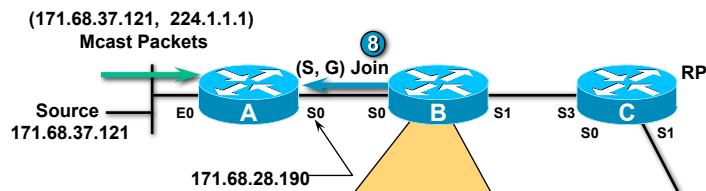
⑦ RP sends (S,G) Joins for all known Sources in Group.

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PIM SM Registering

Source Registers First



```
(*, 224.1.1.1), 00:04:28/00:00:00, RP 171.68.28.140, flags: SP
Incoming interface: Serial1, RPF nbr 171.68.28.140,
Outgoing interface list: Null

(171.68.37.121, 224.1.1.1), 00:04:28/00:01:32, flags:
Incoming interface: Serial0, RPF nbr 171.68.28.190
Outgoing interface list:
Serial1, Forward/Sparse-Dense, 00:04:28/00:01:32
```

B Processes Join, Creates (S, G) State

(After Automatically Creating the (*, G) Entry)

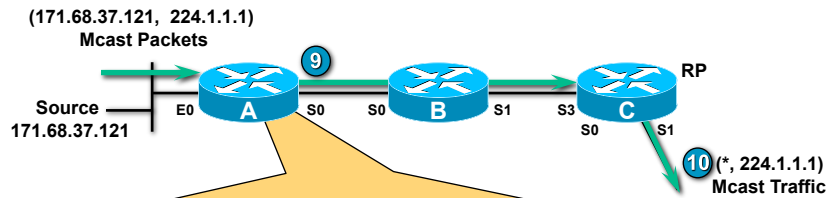
⑧ B sends (S,G) Join toward Source to continue building SPT.

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PIM SM Registering

Source Registers First



```
(*, 224.1.1.1), 00:04:28/00:00:00, RP 171.68.28.140, flags: SP
Incoming interface: Serial0, RPF nbr 171.68.28.191,
Outgoing interface list: Null
```

```
(171.68.37.121, 224.1.1.1), 00:04:28/00:01:32, flags: FT
Incoming interface: Ethernet0, RPF nbr 0.0.0.0,
Outgoing interface list:
Serial0, Forward/Sparse-Dense, 00:04:28/00:01:32
```

A Processes the (S, G) Join; Adds Serial0 to OIL

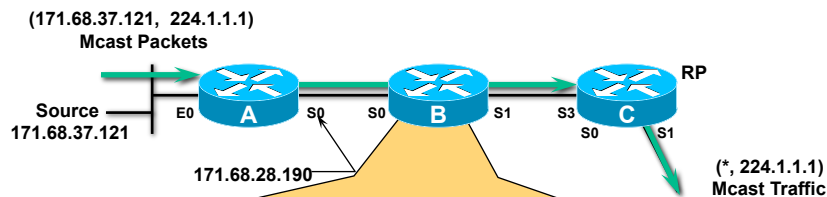
- 9 RP begins receiving (S,G) traffic down SPT.
- 10 RP forwards (S,G) traffic down Shared Tree to receivers.

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PIM SM Registering

Source Registers First



```
(*, 224.1.1.1), 00:04:28/00:00:00, RP 171.68.28.140, flags: SP
Incoming interface: Serial1, RPF nbr 171.68.28.140,
Outgoing interface list: Null
```

```
(171.68.37.121, 224.1.1.1), 00:04:28/00:01:32, flags: T
Incoming interface: Serial0, RPF nbr 171.68.28.190
Outgoing interface list:
Serial1, Forward/Sparse-Dense, 00:04:28/00:01:32
```

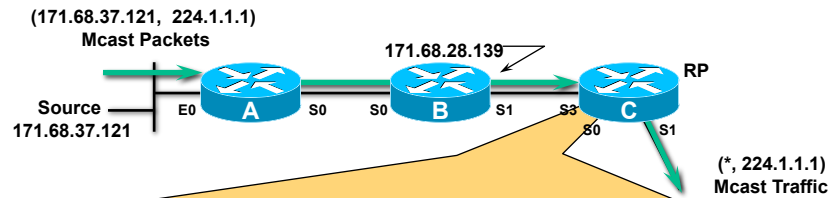
Final State in B After Receivers Join

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PIM SM Registering

Source Registers First



```
(*, 224.1.1.1), 00:09:21/00:00:00, RP 171.68.28.140, flags: S
Incoming interface: Null, RPF nbr 0.0.0.0,
Outgoing interface list:
Serial1, Forward/Sparse-Dense, 00:03:14/00:02:46

(171.68.37.121, 224.1.1.1, 00:01:15/00:02:46, flags: T
Incoming interface: Serial3, RPF nbr 171.68.28.139,
Outgoing interface list:
Serial1, Forward/Sparse-Dense, 00:00:49/00:02:11
```

Final State in RP After Receivers Join

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PIM SM Registering— Receivers Along the SPT

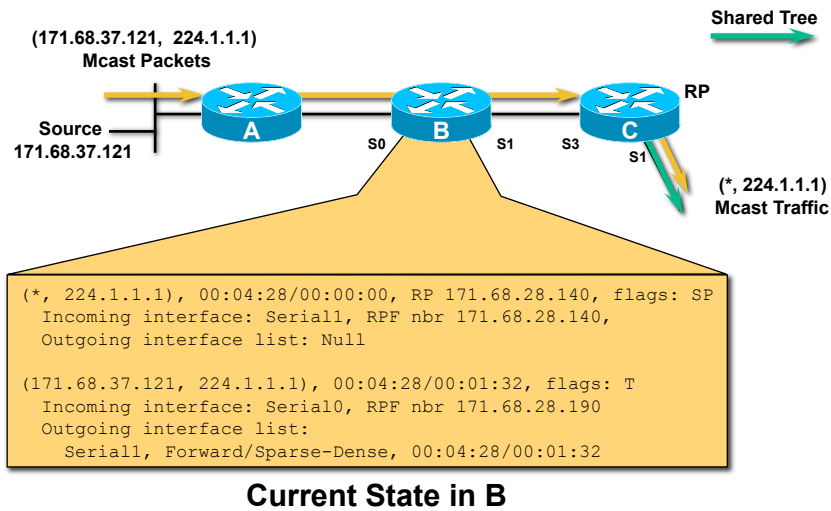


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PIM SM Registering

Receivers Along the SPT

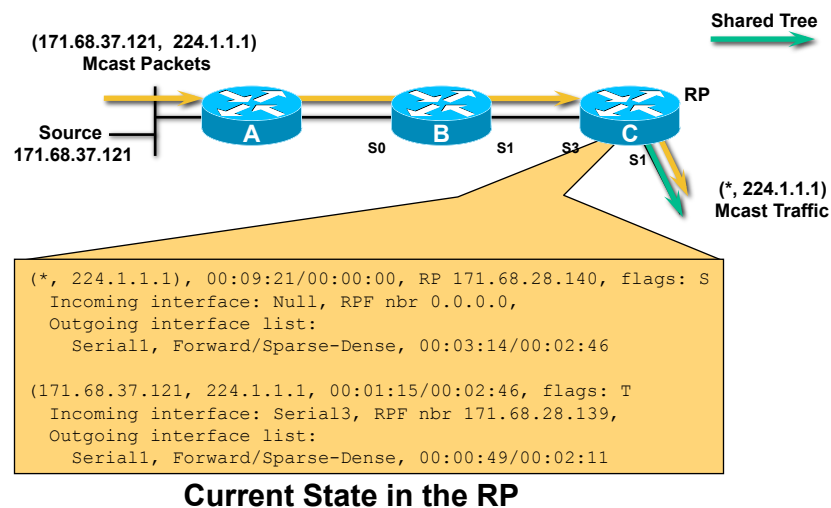


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PIM SM Registering

Receivers Along the SPT

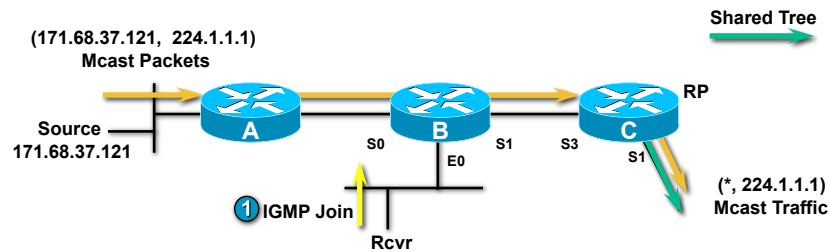


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PIM SM Registering

Receivers Along the SPT



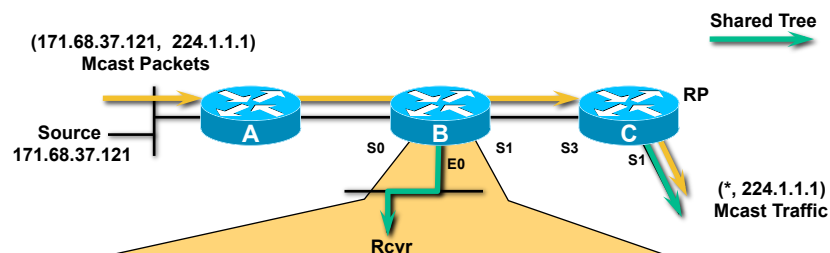
- ① Rcvr wishes to receive group G traffic. Sends IGMP Join for G.

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PIM SM Registering

Receivers Along the SPT



```
(*, 224.1.1.1), 00:04:28/00:00:00, RP 171.68.28.140, flags: SC
Incoming interface: Serial1, RPF nbr 171.68.28.140,
Outgoing interface list:
  Ethernet0, Forward/Sparse-Dense, 00:00:30/00:02:30

(171.68.37.121, 224.1.1.1), 00:04:28/00:01:32, flags: CT
Incoming interface: Serial0, RPF nbr 171.68.28.190
Outgoing interface list:
  Serial1, Forward/Sparse-Dense, 00:04:28/00:01:32
  Ethernet0, Forward/Sparse-Dense, 00:00:30/00:02:30
```

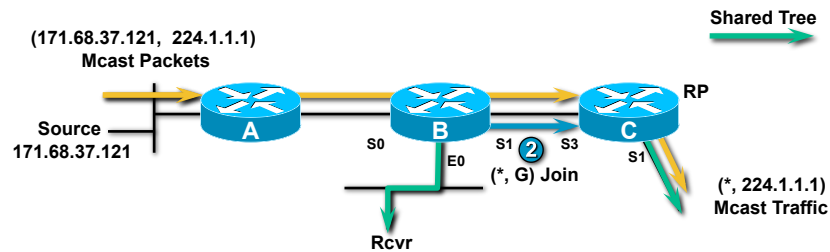
State in B after Rcvr Joins Group

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PIM SM Registering

Receivers Along the SPT



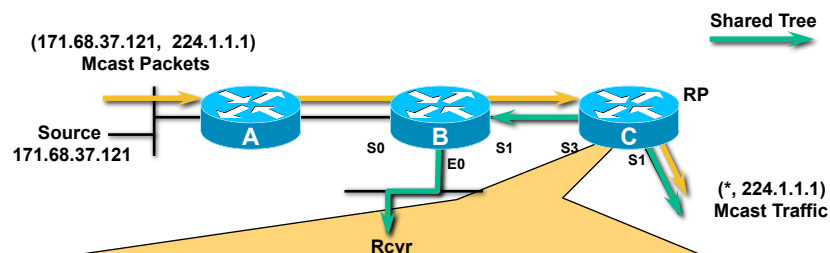
- ② B triggers a (*,G) Join to join the Shared Tree

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PIM SM Registering

Receivers Along the SPT



```
(*, 224.1.1.1), 00:09:21/00:00:00, RP 171.68.28.140, flags: S
Incoming interface: Null, RPF nbr 0.0.0.0,
Outgoing interface list:
  Serial11, Forward/Sparse-Dense, 00:03:14/00:02:46
  Serial13, Forward/Sparse-Dense, 00:00:10/00:02:50

(171.68.37.121, 224.1.1.1, 00:01:15/00:02:46, flags: T
Incoming interface: Serial13, RPF nbr 171.68.28.139,
Outgoing interface list:
  Serial11, Forward/Sparse-Dense, 00:00:49/00:02:11
```

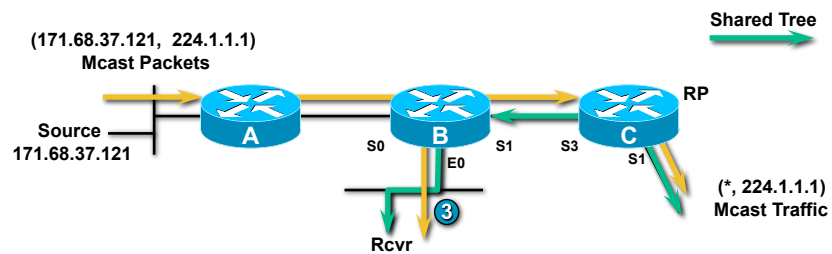
State in RP after B Joins Shared Tree

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PIM SM Registering

Receivers Along the SPT



③ Group G traffic begins to flow to Rcvr.

(Note: 171.68.37.121 traffic doesn't flow to RP then back down to B)

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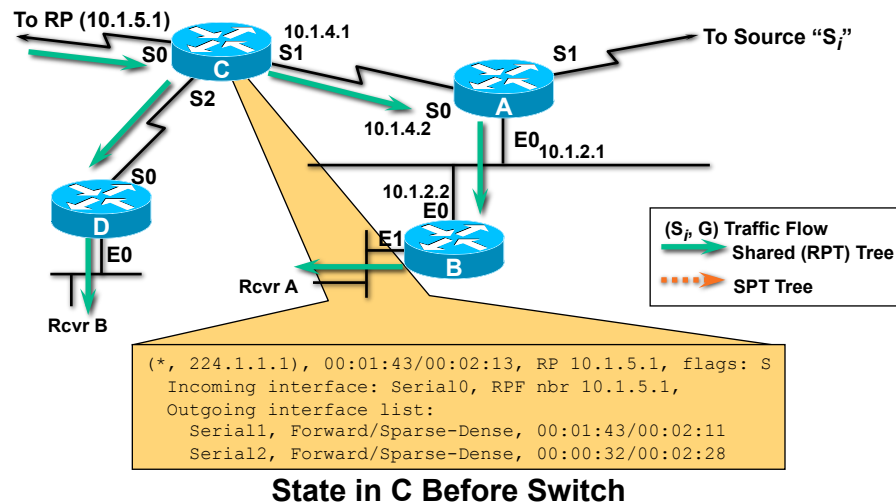
PIM SM SPT-Switchover

- SPT Thresholds may be set for any Group
 - Access Lists may be used to specify which Groups
 - Default Threshold = 0kbps (I.e. immediately join SPT)
 - Threshold = "infinity" means "never join SPT"
 - Don't use values in between "0" and "infinity"**
- Threshold triggers Join of Source Tree
 - Sends an (S,G) Join up SPT for next "S" in "G" packet received

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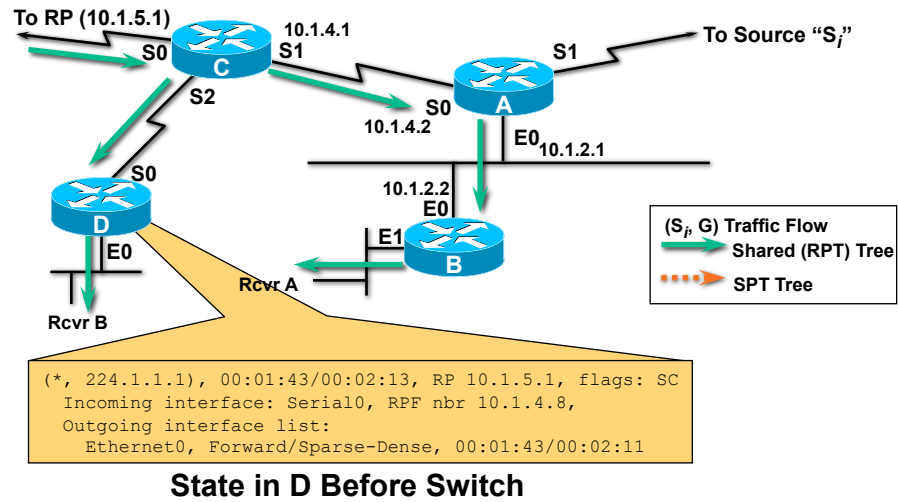
PIM SM SPT-Switchover



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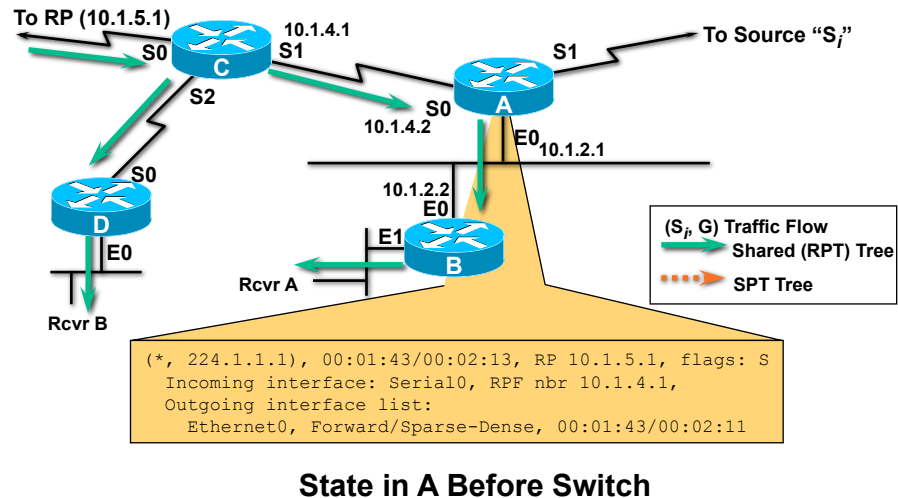
PIM SM SPT-Switchover



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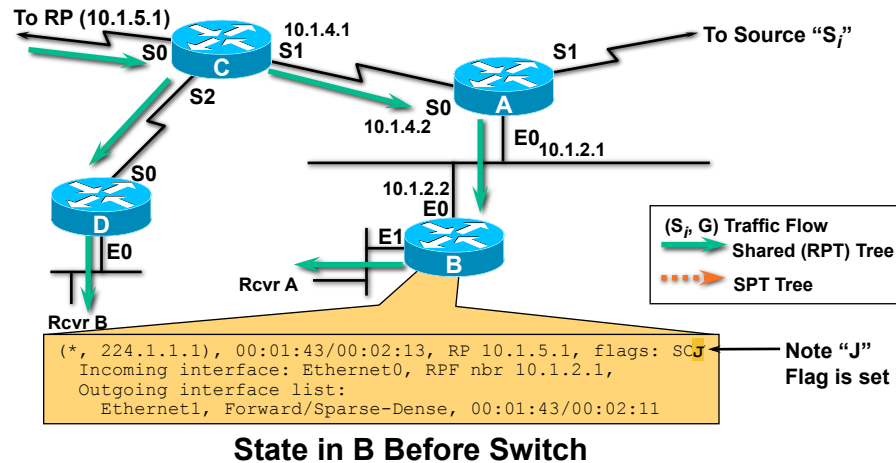
PIM SM SPT-Switchover



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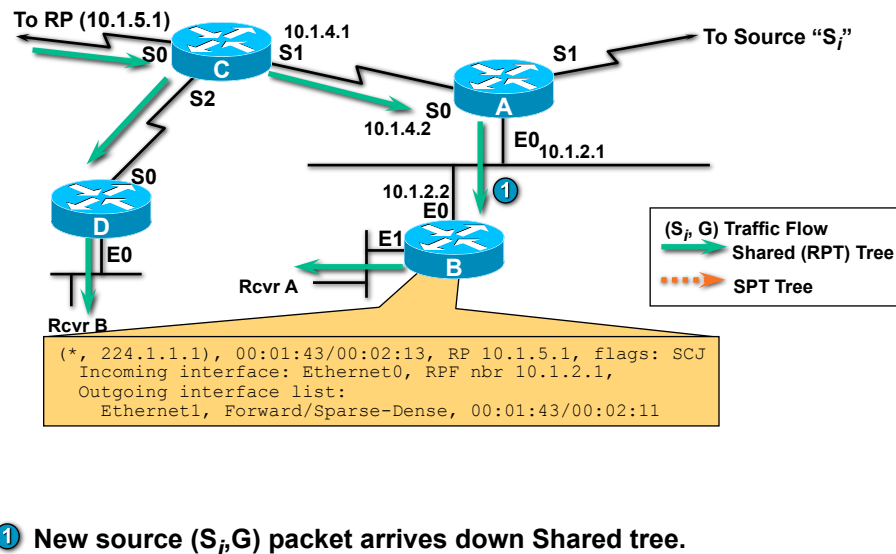
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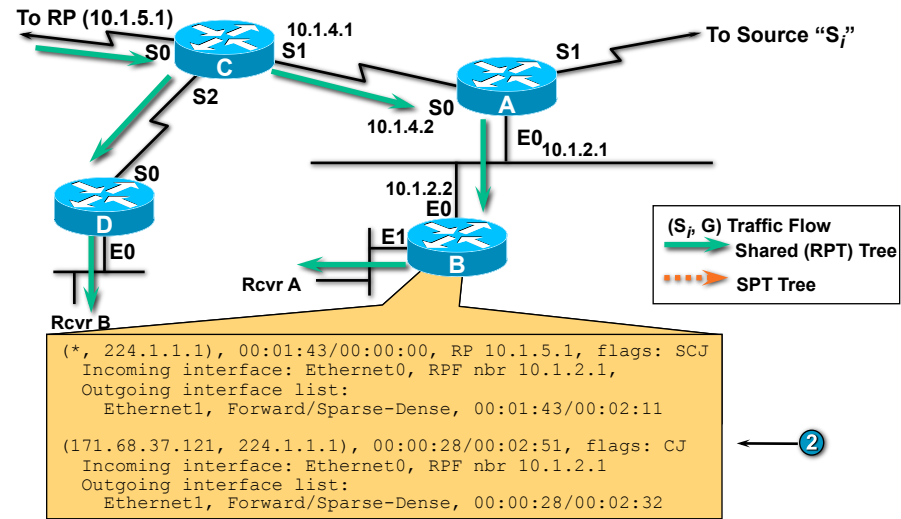
PIM SM SPT-Switchover



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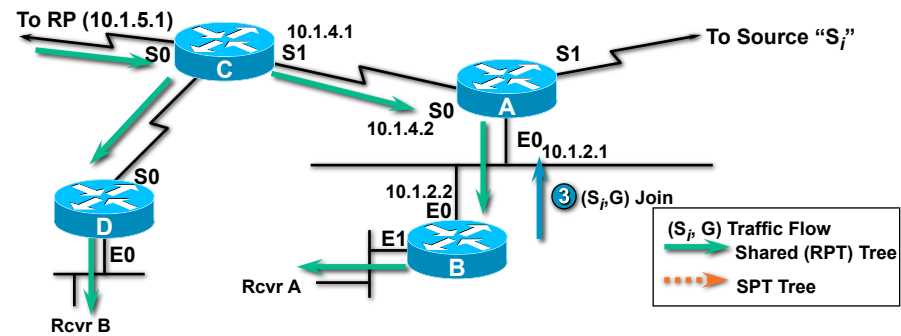
74

PIM SM SPT-Switchover



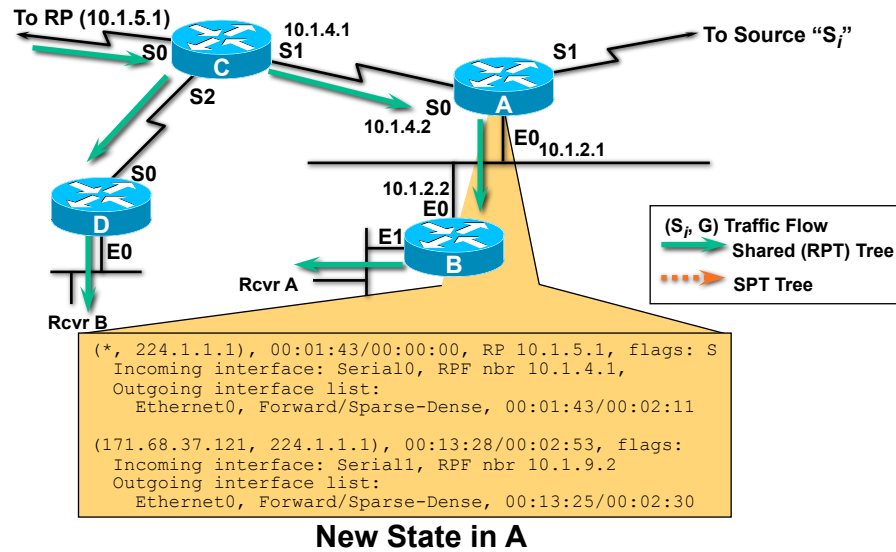
② B creates (S_p, G) state.

PIM SM SPT-Switchover



③ B sends (S_p, G) Join towards S_i.

PIM SM SPT-Switchover



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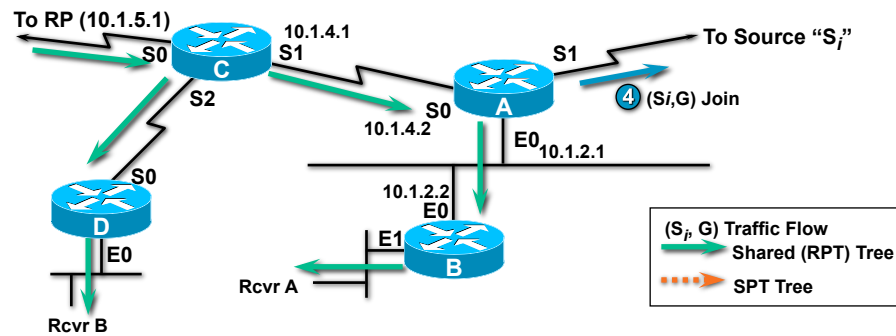
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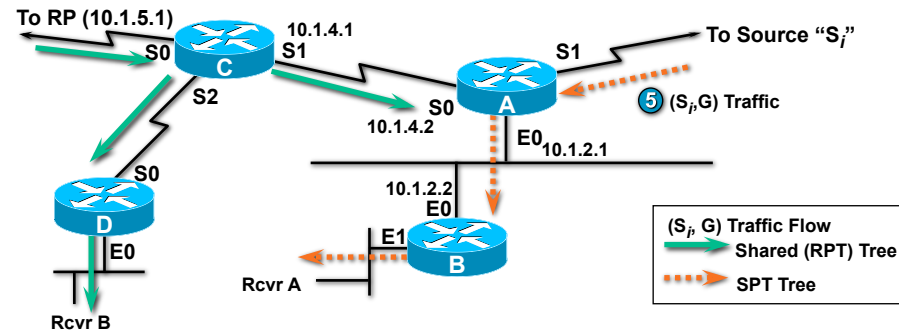
14588_04_2008_c1

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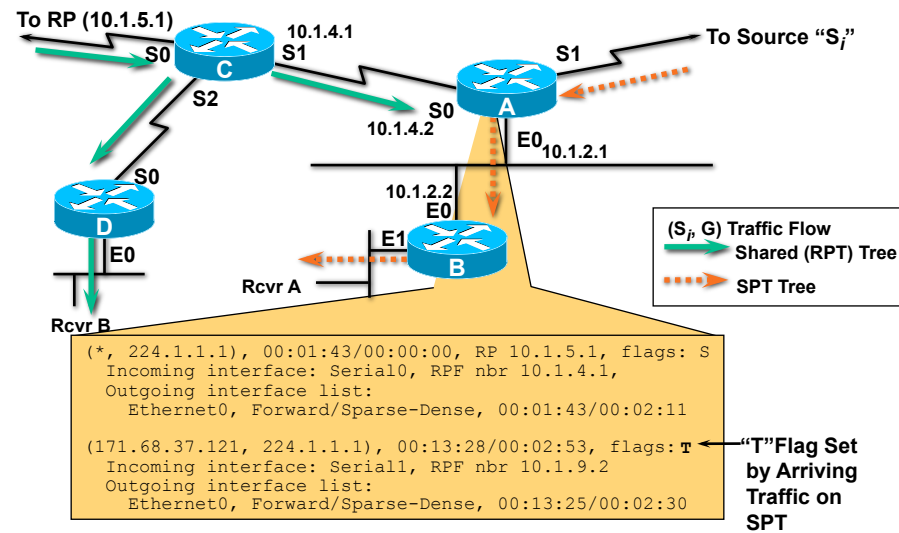
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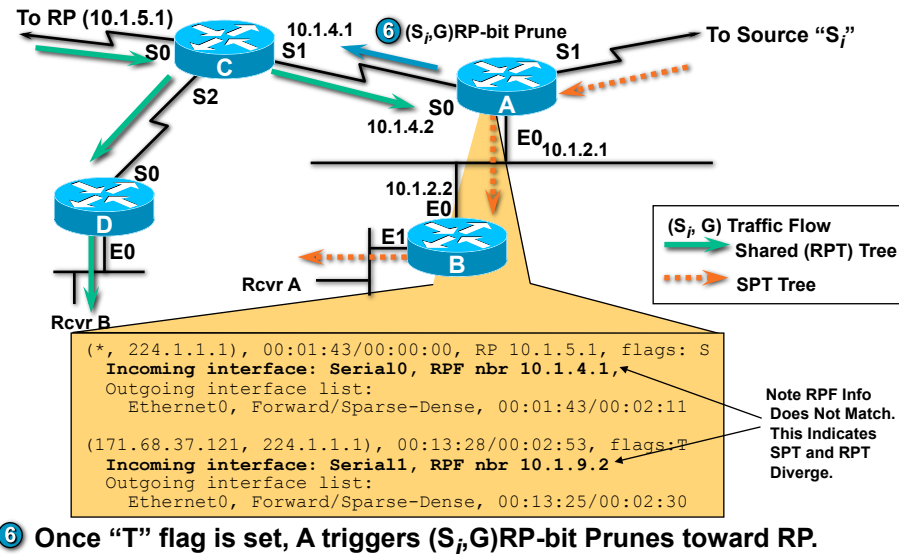
PIM SM SPT-Switchover



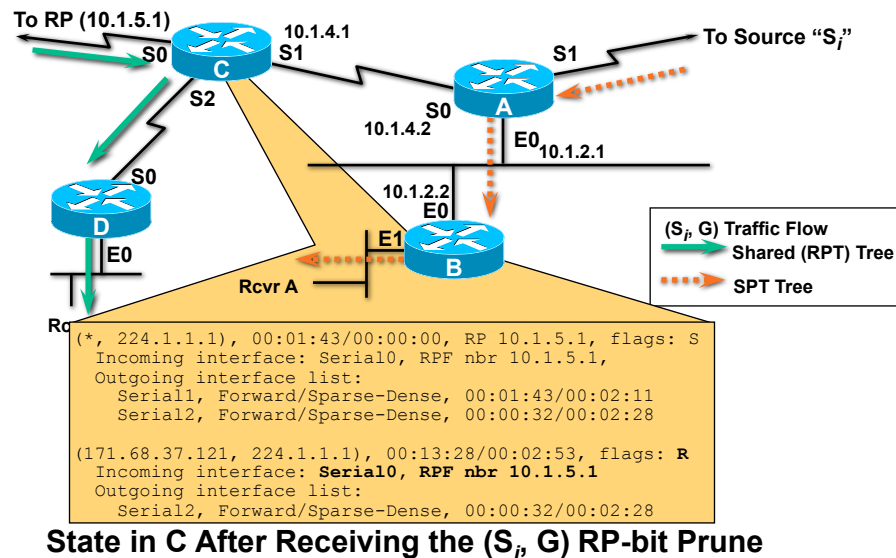
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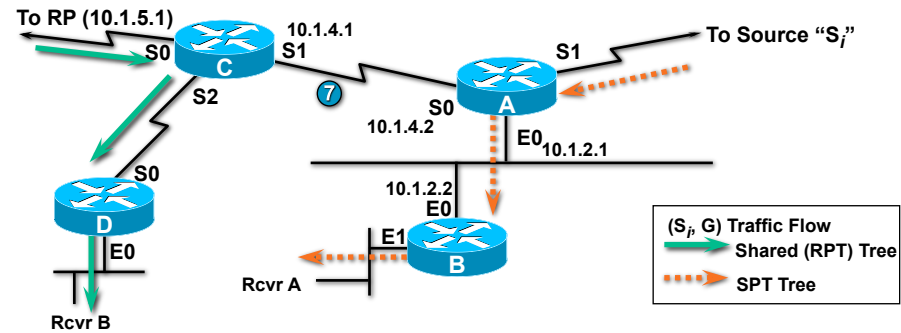
PIM SM SPT-Switchover



PIM SM SPT-Switchover



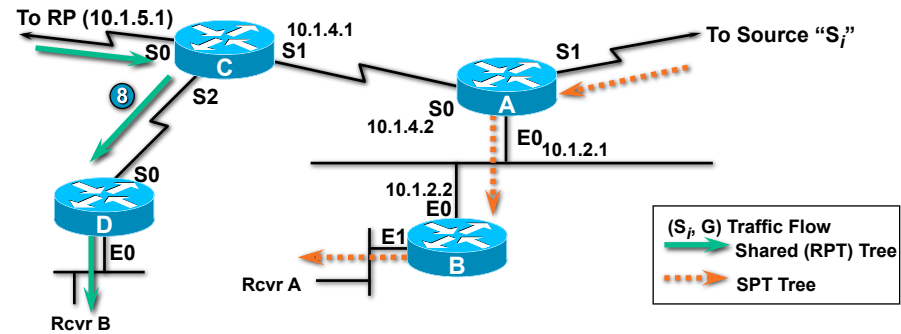
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