

Slides  
rev-09

# PIM Routing

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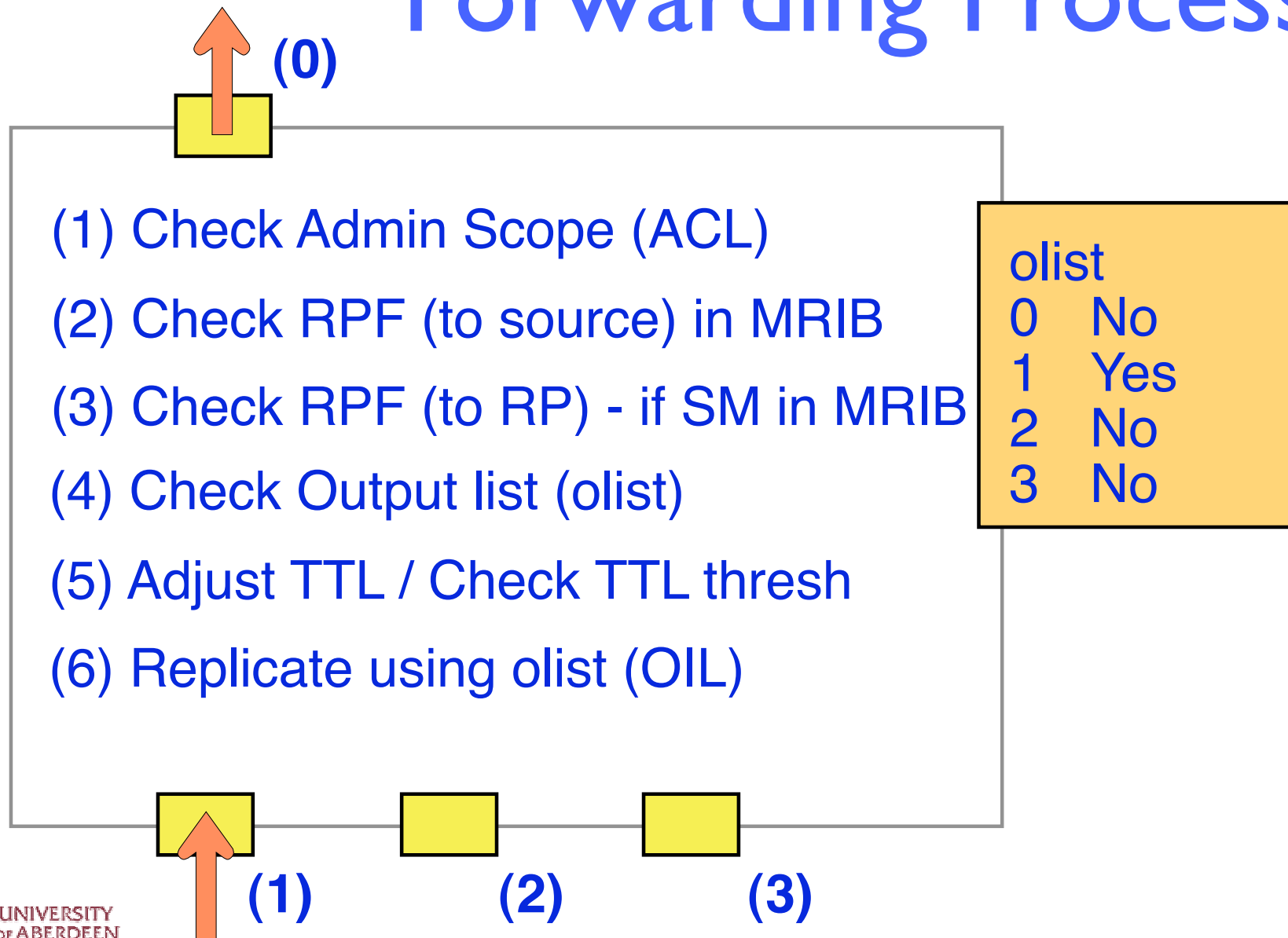
IP Multicast Workshop at Networkshop 2006

Slides (as flash, QT) at:

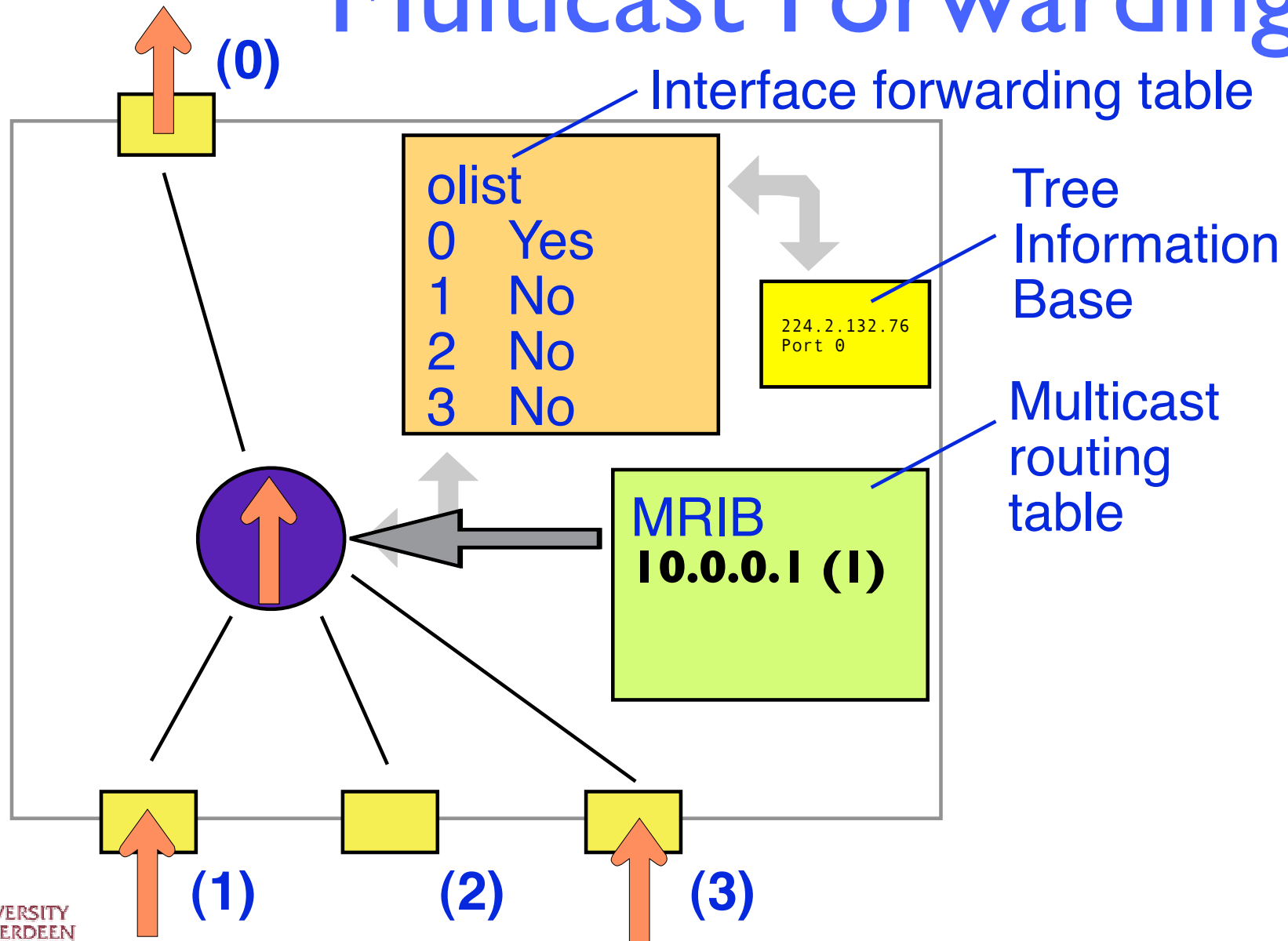
<http://www.erg.abdn.ac.uk/users/gorry/ipmulticast/docs/>

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- Part 1: Multicast Forwarding
  - Part 2: ASM Register
  - Part 3: Receiver Join
  - Part 4: Variations
  - Part 5: Pruning

# Forwarding Process

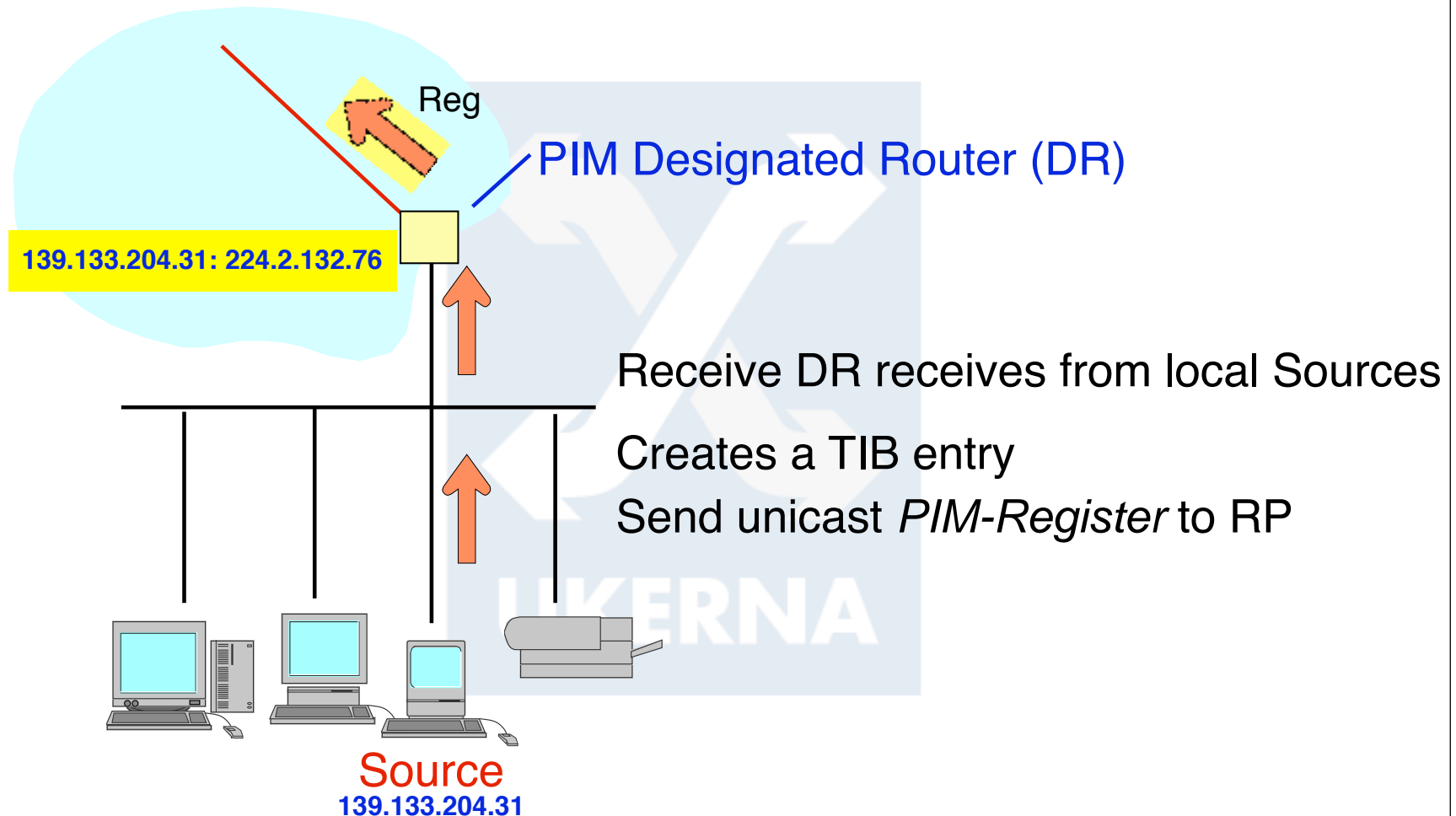


# Multicast Forwarding



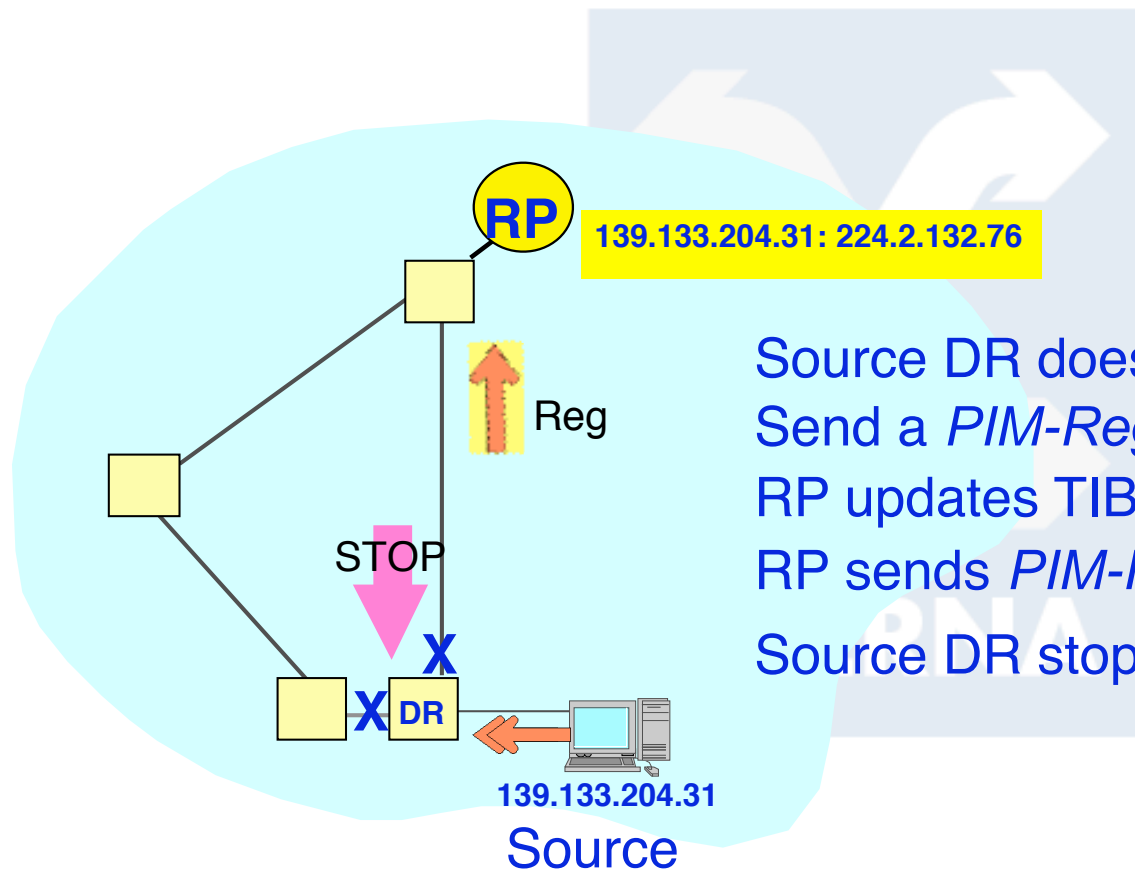
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# Sending to the LAN DR



PIM Designated Router (DR) may be IGMP Querier

# Telling the RP about a Source



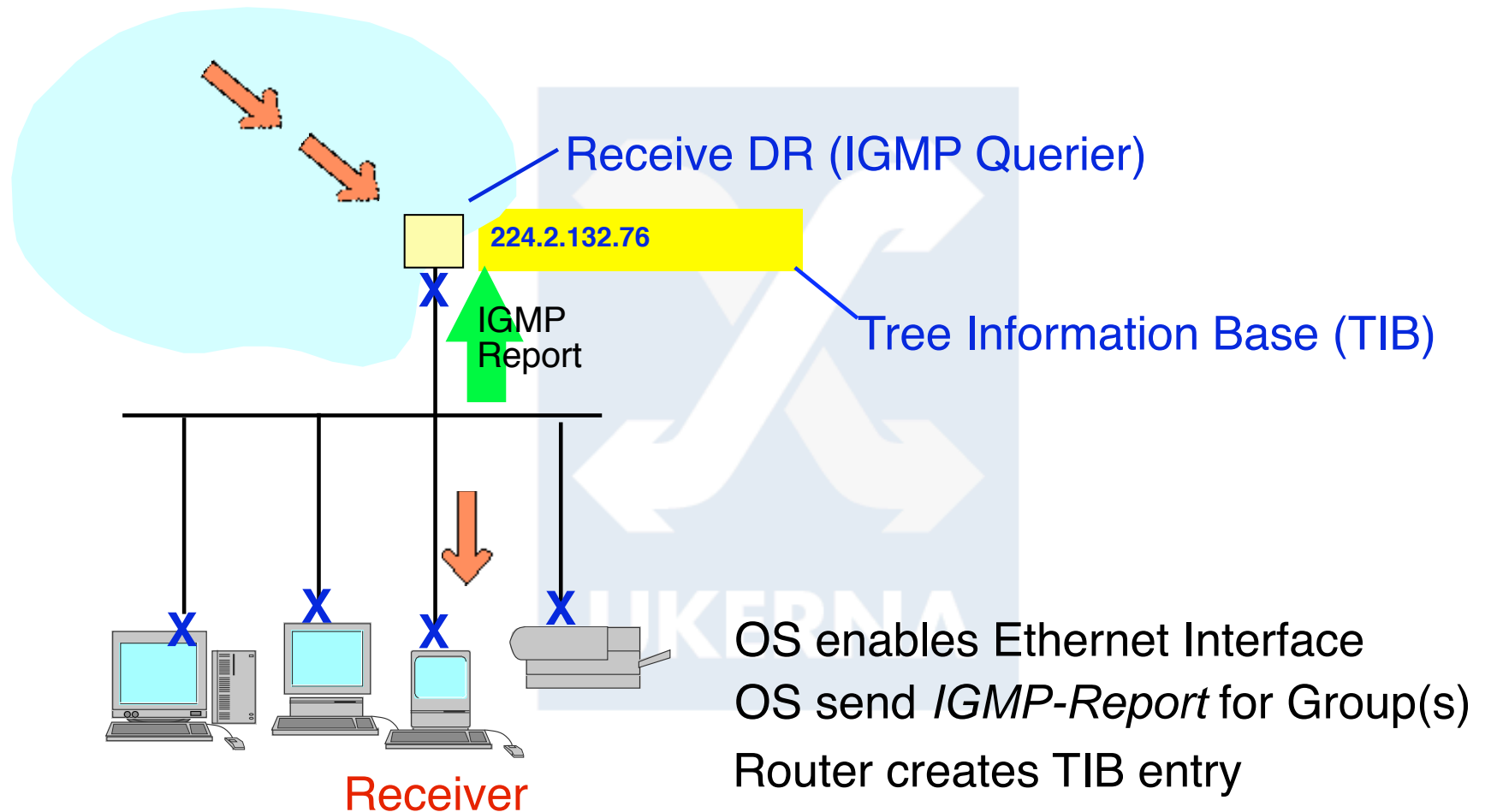
Source DR does not forward flows  
Send a *PIM-Register* to the RP  
RP updates TIB  
RP sends *PIM-Register-STOP*  
Source DR stops registering (for a while)

DR waits for a *PIM-Join*

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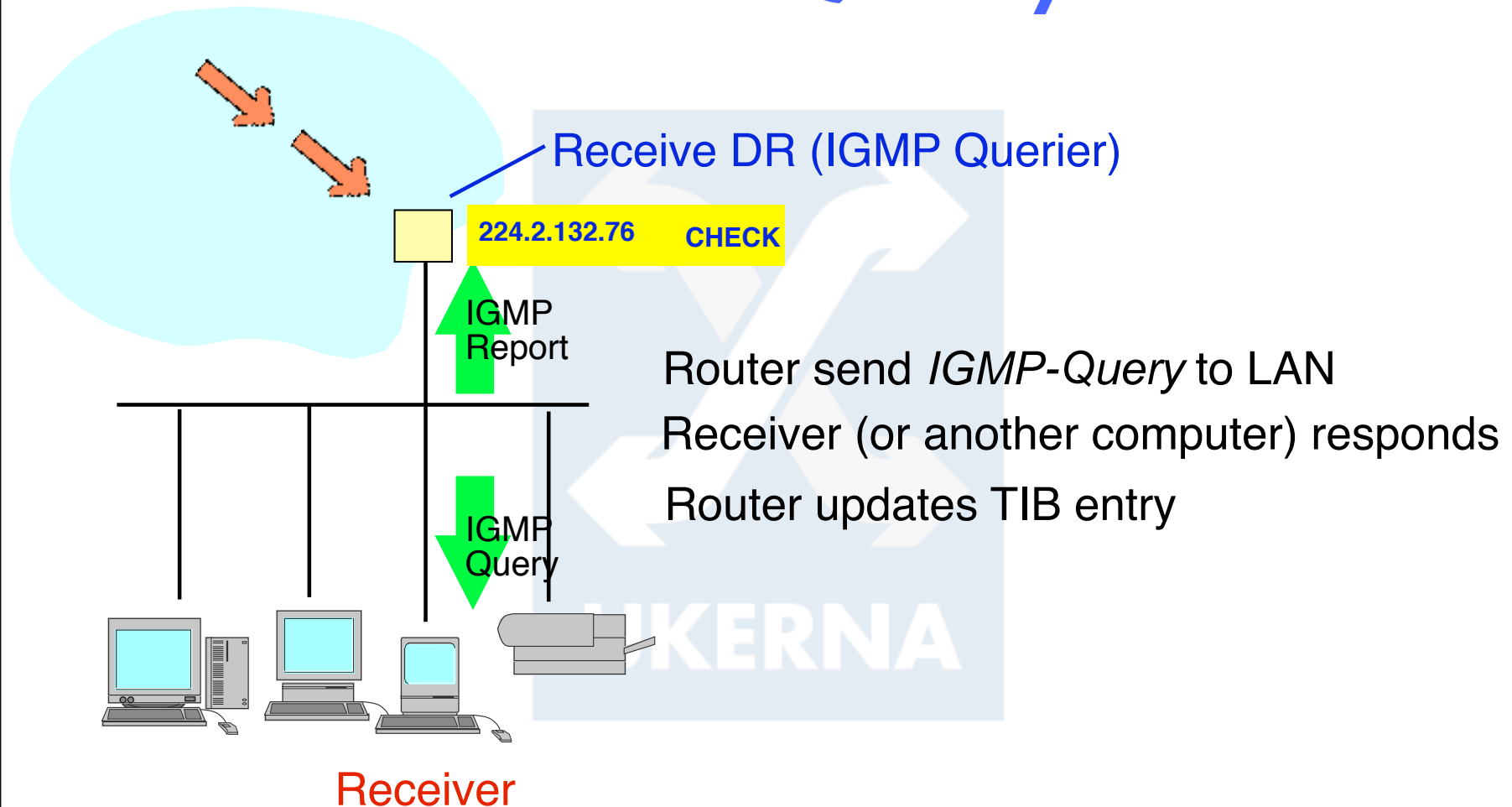


# OS Sends IGMP Report

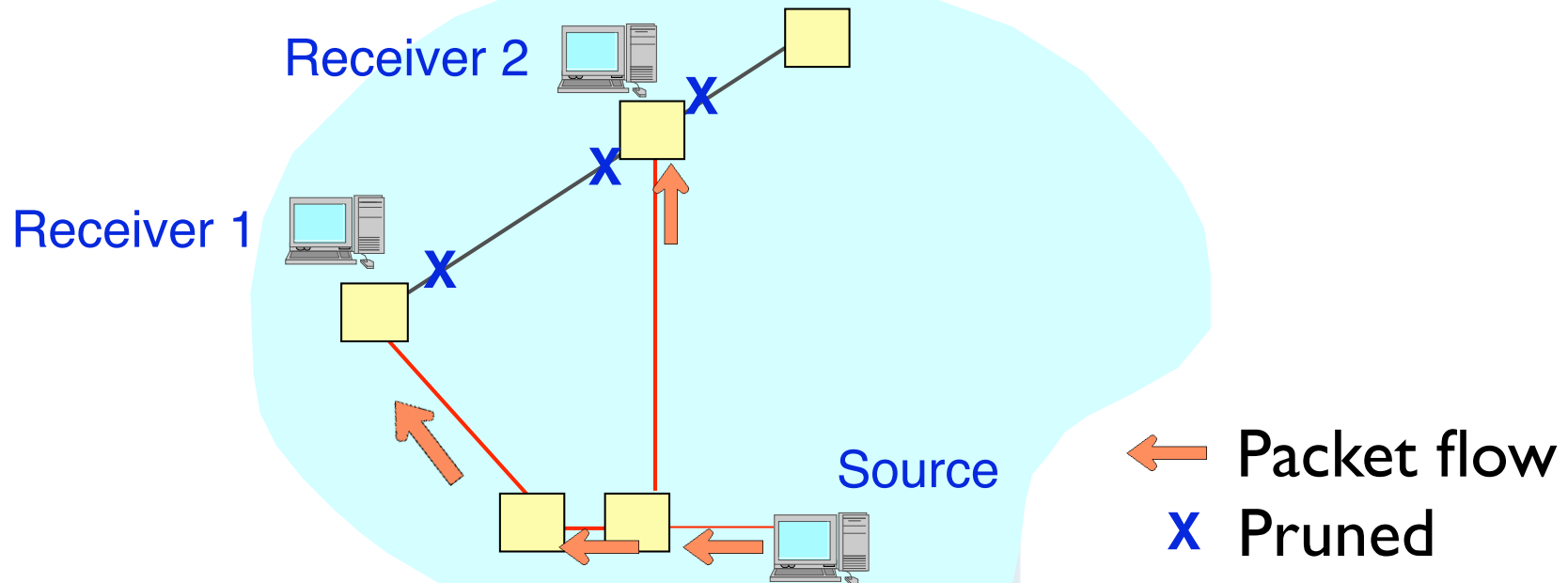


OS enables Ethernet Interface  
OS send *IGMP-Report* for Group(s)  
Router creates TIB entry  
Router enables LAN interface  
Router forwards packets to Receiver

# IGMP Query



# Joining / Pruning the Tree



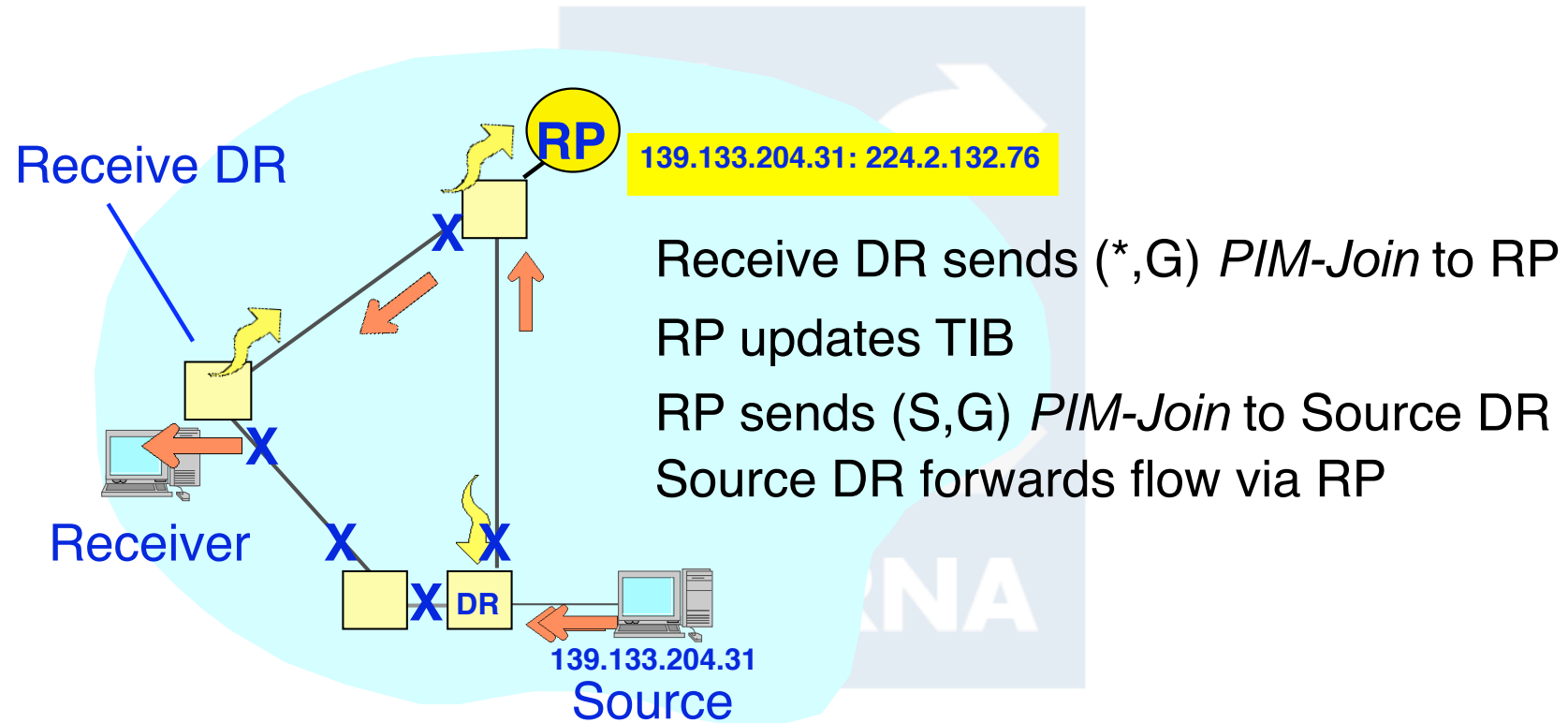
## Joining

Routers do not forward flows until a *Join* is received  
Routers send *Join* if they wish to receive a flow

## Pruning

Routers *Prune* flows when there are no *Joins*

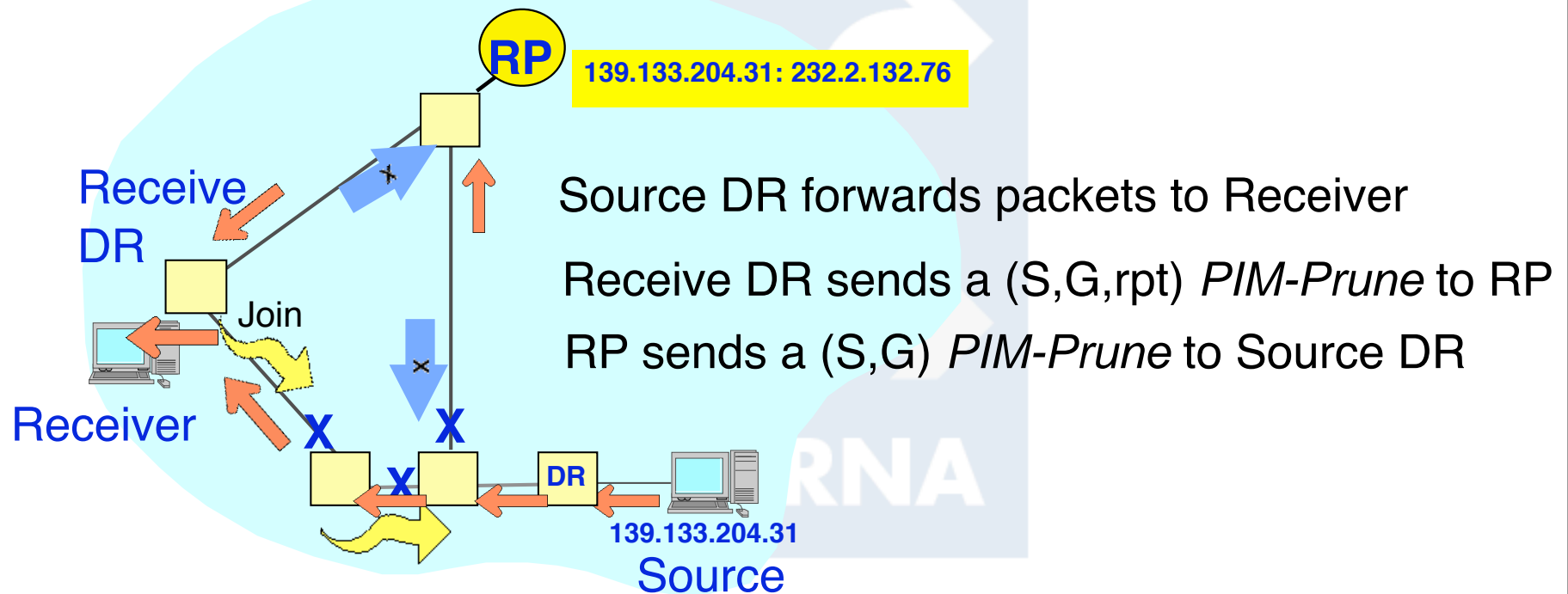
# Receiving via the RP



# Receiving from Source

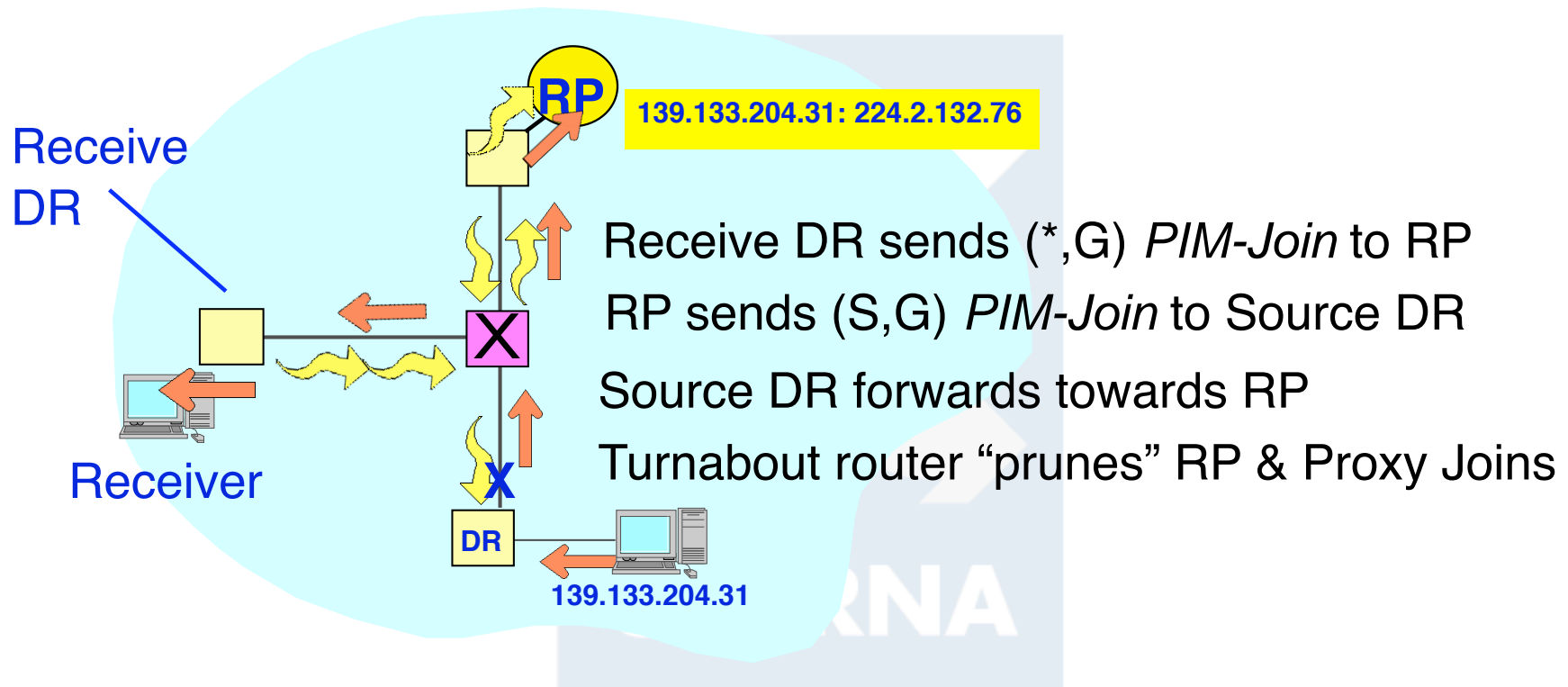
## Receive DR discovers Source address

Receive DR sends (S,G) *PIM-Join* to Source



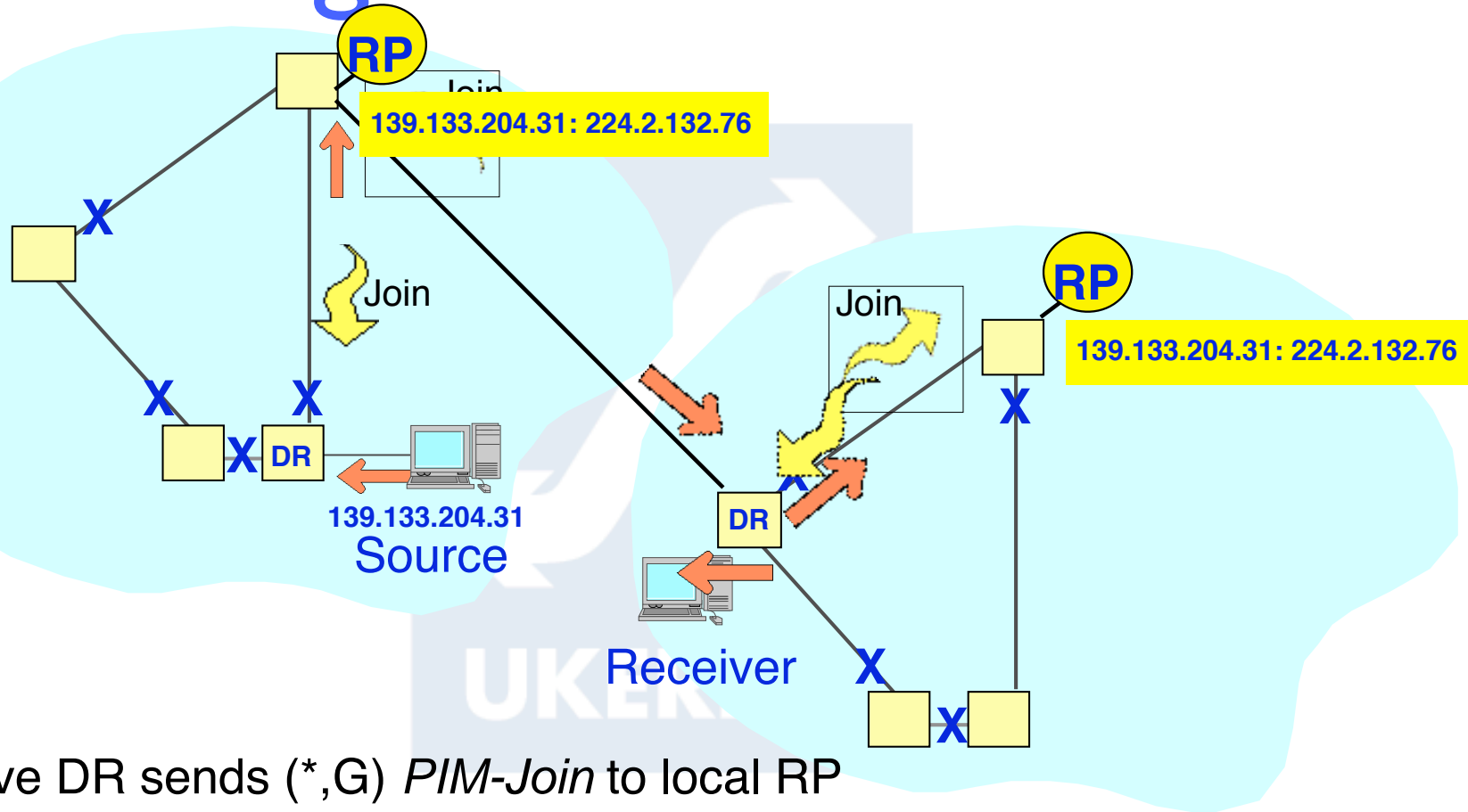
## Packets forwarded on shortest path (SPT)

# Turnabout Router



Traffic never flows up the RPT  
to then flow back down the same SPT!

# Finding a Remote Source



Receiver DR sends  $(*,G)$  *PIM-Join* to local RP

Local RP sends  $(S,G)$  *PIM-Join* to Source

Source DR forwards flow to Receiver

Local RP needed  
to know Source!

- 
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PIM-SSM

- *when there are few sources*

Bi-Dir PIM

- *when there are many sources*



# Sending SSM from the DR

Rules change for 232/8 (SSM!)

Source DR role changes

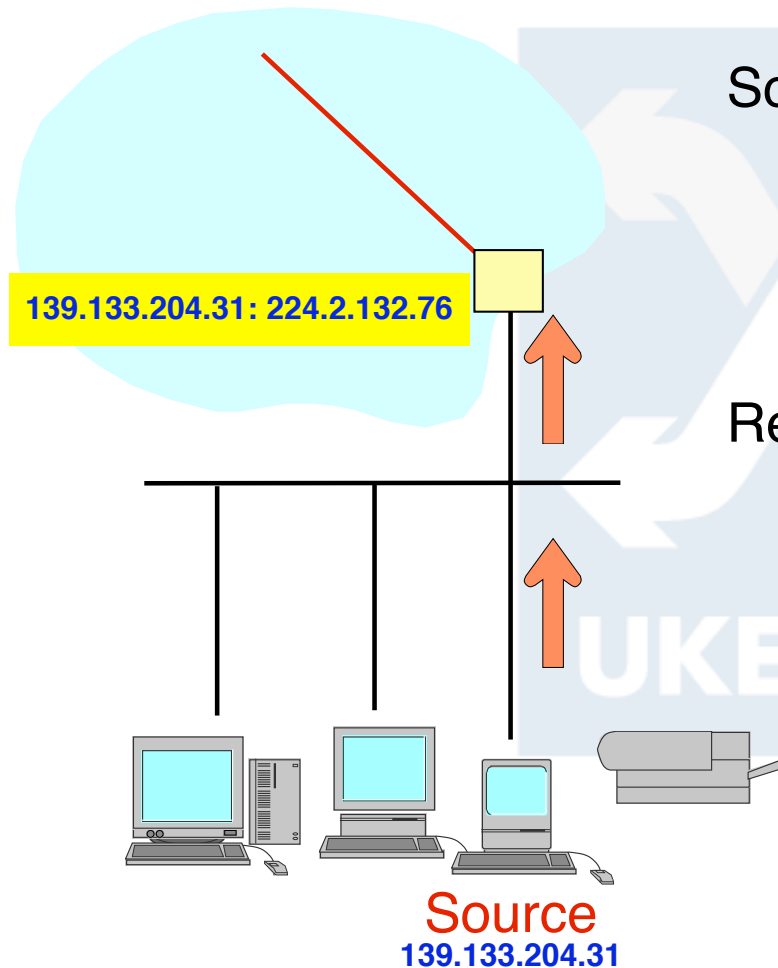
No register sent from DR

No (\*,G) PIM-Join for 232/8

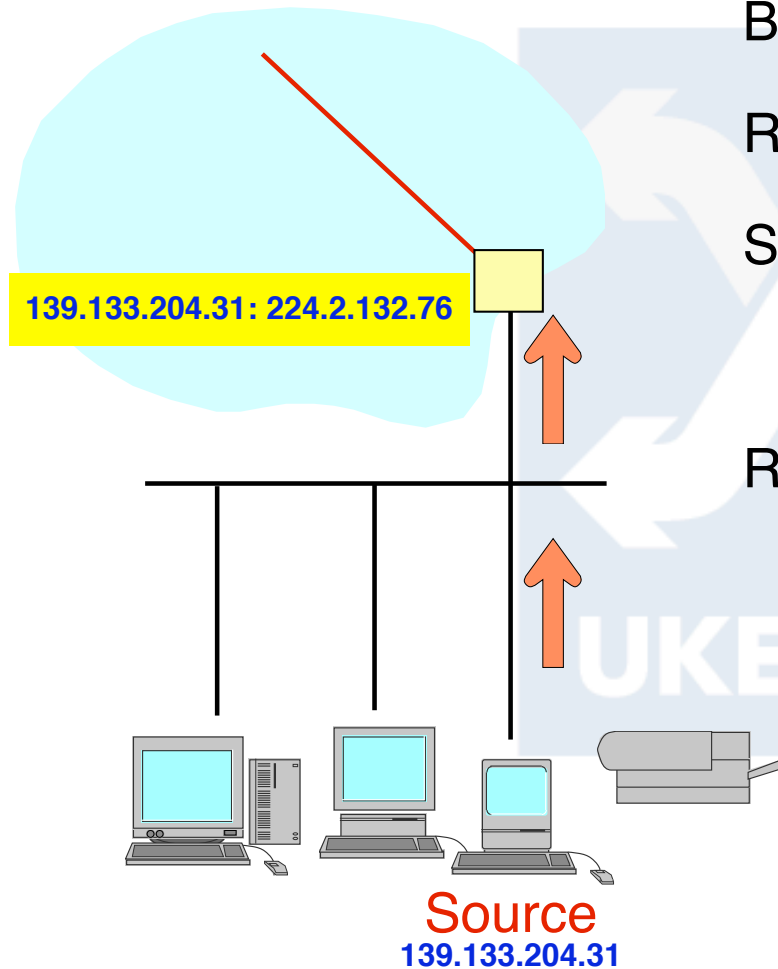
Receive DR Join changes

(S,G) Join directly to source (IGMPv3)

RPs not to handle these groups



# Sending BiDir from the DR



BiDir negotiated in *PIM Hello*

Rules change

Source DR role changes

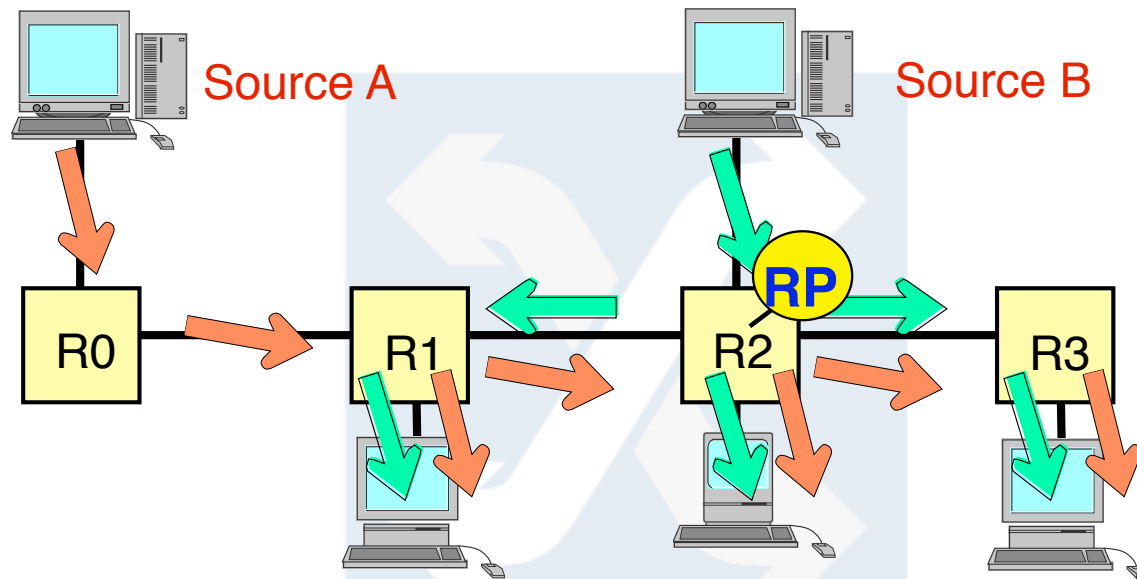
No *Register* sent from DR

Receive DR forwarding changes

Send natively to RP

Other routers can see the packets

# BiDir Routing



No per-source state

Good for many sources (c.f. SSM)

No problems with bursty sources (as in SSM)

# Network changes for BiDir

RP much simpler (No tunnels)

No problems with bursty sources

Can be any multicast router

Problems

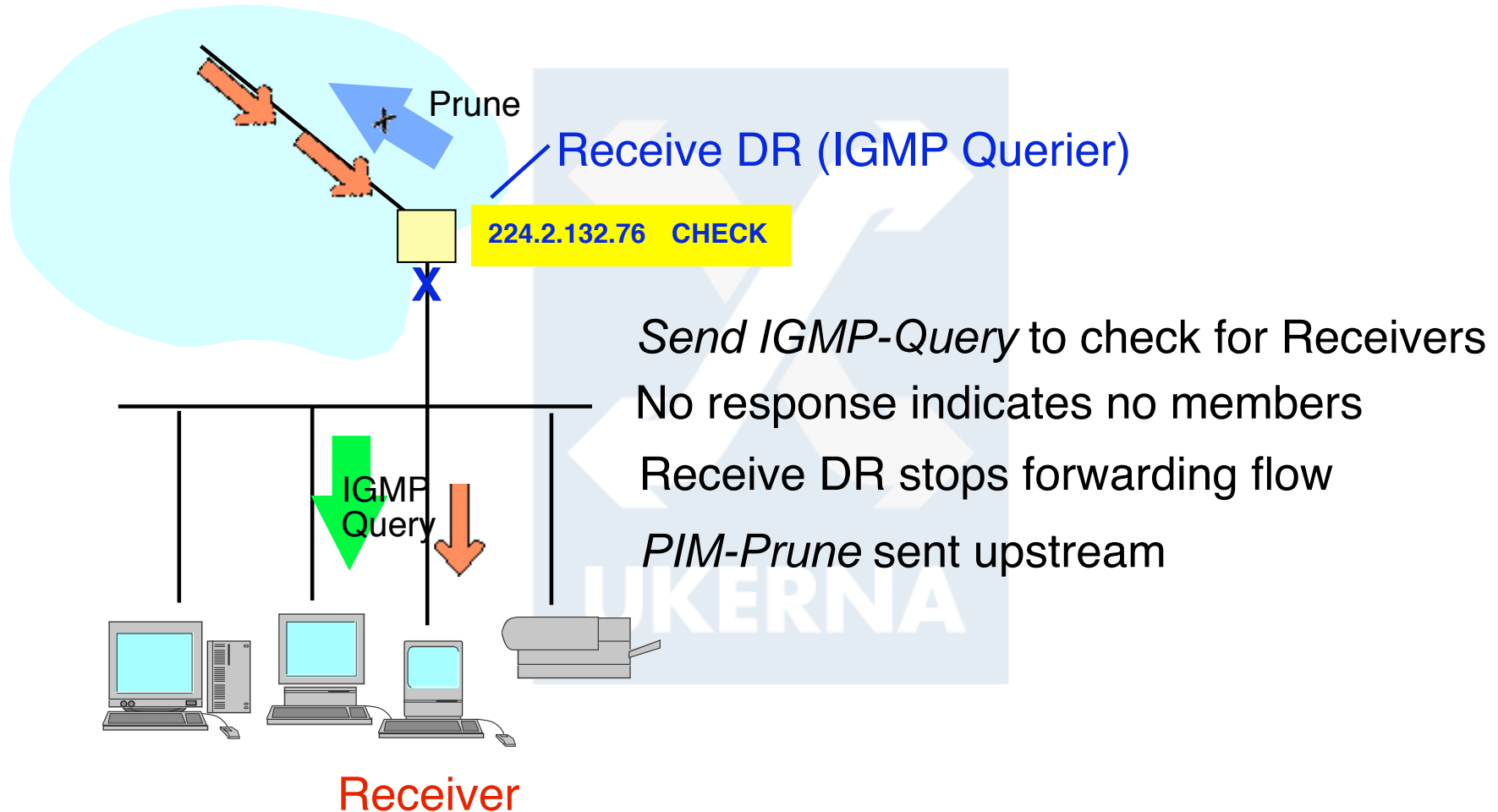
Does not directly interoperate with SM

All traffic can flow to the RP

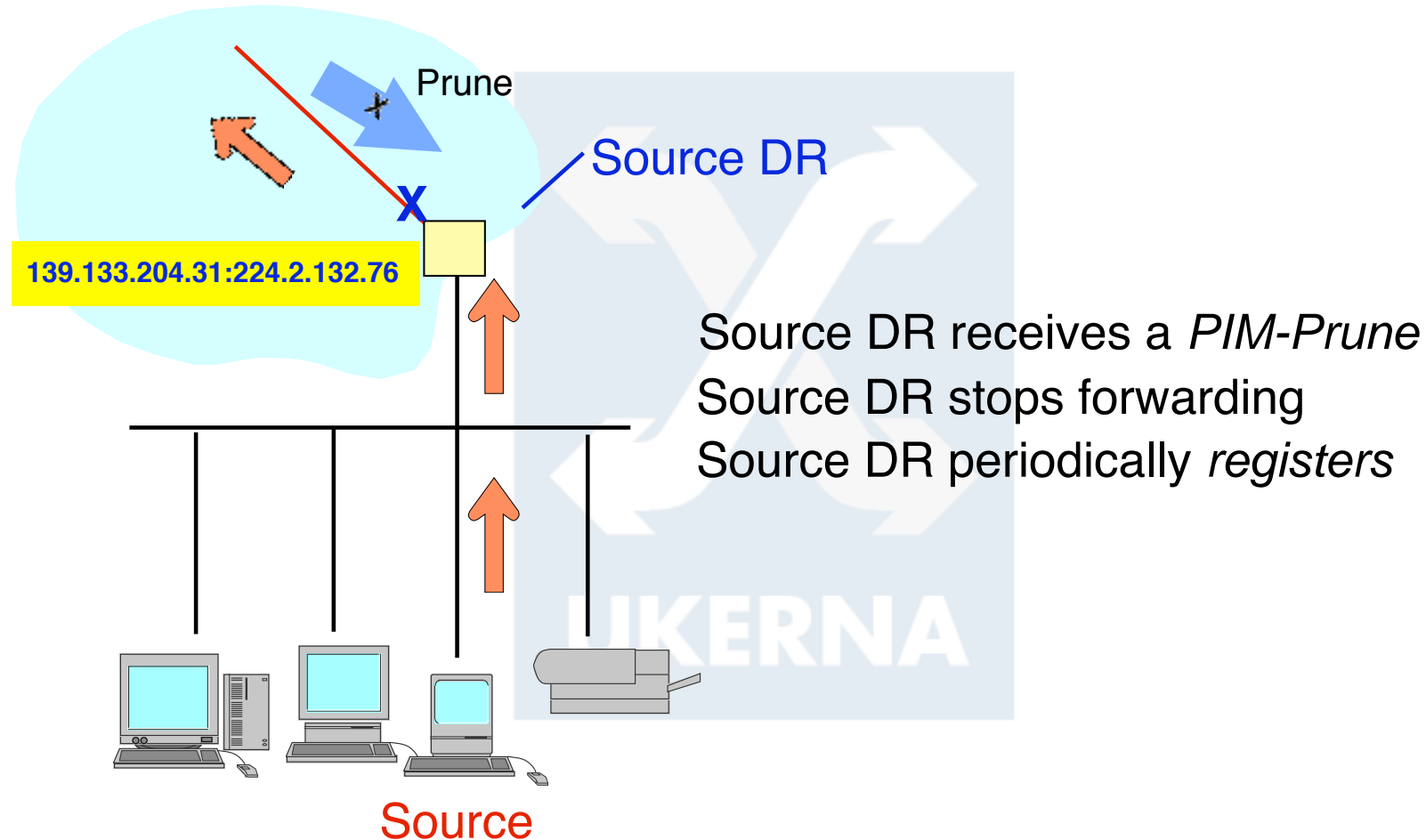
RP placement important

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# Leaving the Group



# Stopping a Source



# So Finally....

Three key things

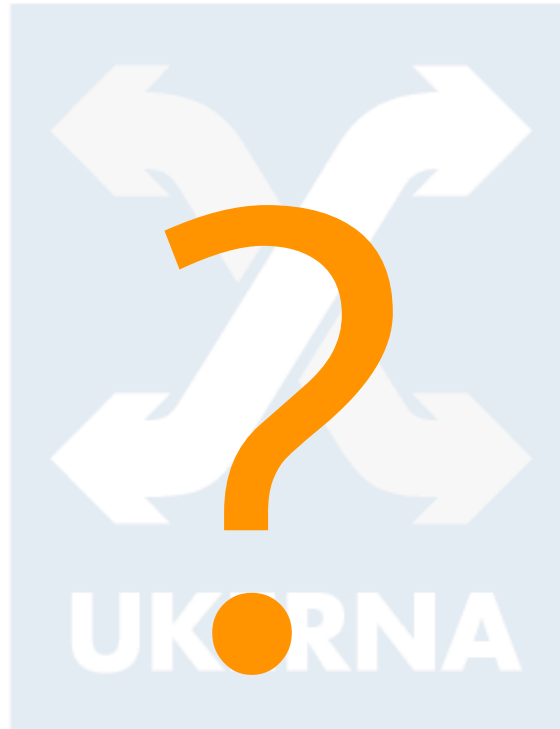
IGMP tells a Receive Router which flows to Receive  
RP's tell Receive Routers about Sources (via packets)  
Join/Prune used to build trees

Multicast isn't hard

It is very different to unicast  
Need to work with new "tools"



# Question & Answers



Slides (as flash, QT) at:

<http://www.erg.abdn.ac.uk/users/gorry/ipmulticast/docs/>

# PIM Message Types

## PIM Messages

- 0: HELLO
- 1: REGISTER (includes tunnelled packet)
- 2: REGISTER STOP
- 3: JOIN/PRUNE
- 4: Bootstrap Router (BSR) - SM Only
- 5: ASSERT
- 6: GRAFT - DM Only
- 7: GRAFT-ACK - DM Only
- 8: CANDIDATE RP-ADVERTISEMENT (with BSR)
- 10: BiDir

## Common PIM Flags (displayed by "mroute")

- |   |           |  |
|---|-----------|--|
| C | Connected | - One or members wish to receive flow for Group G    |
| F | Register  | - This DR has a local Source for Group G             |
| J | Join      | - Router has sent a Join message for this flow       |
| P | Pruned    | - Router does not need to forward flow for Group G   |
| T | Tree      | - Router is receiving directly from the Source (S,G) |
| X | Turnabout | - Router is ending proxy-joins to the Source (S,G)   |