PIR

(Programmable Inter-domain Routing)

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Some ancient history

Previous (academic) work

2004/5 RCP
Nick Feamster, Jennifer Rexford, Matthew Caesar, et al
(Princeton, MIT, ATT, UC Berkeley)

The Case for Separating Routing from Routers ACM SIGCOMM Future directions in network architecture - FDNA '04
Design and Implementation of a Routing Control Platform - NSDI'05 (Networked Systems Design & Implementation)

2007 Morpheus
Jennifer Rexford,et al

Making Routing Programmable (INM '07) SIGCOMM Workshop on Internet Network Management

2007 IRSCP
Patrick Verkaik, Dan Pei, Tom Scholl , Aman Shaikh ,Alex Snoeren Jacobus van der Merwe (ATT,UCSD)

Wresting Control from BGP: Scalable Fine-grained Route Control

RCP (2004)

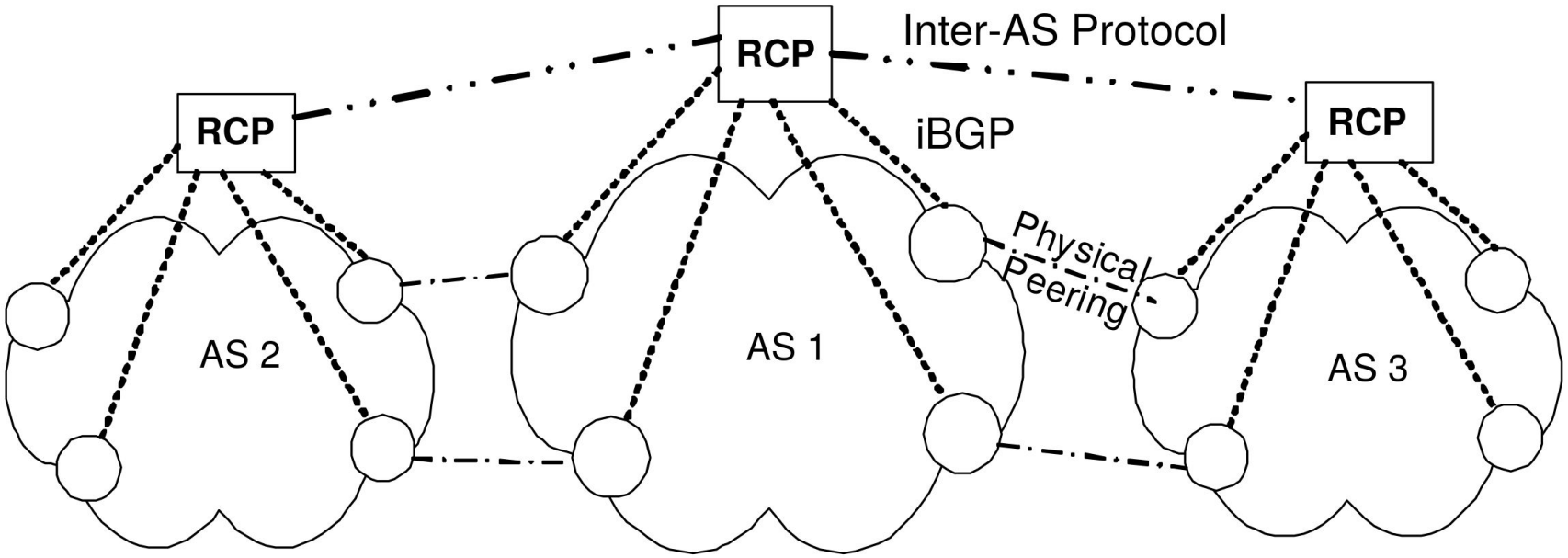


Figure 1: A Routing Control Platform (RCP) for the Internet. Circles represent conventional routers.

RCP (2004)

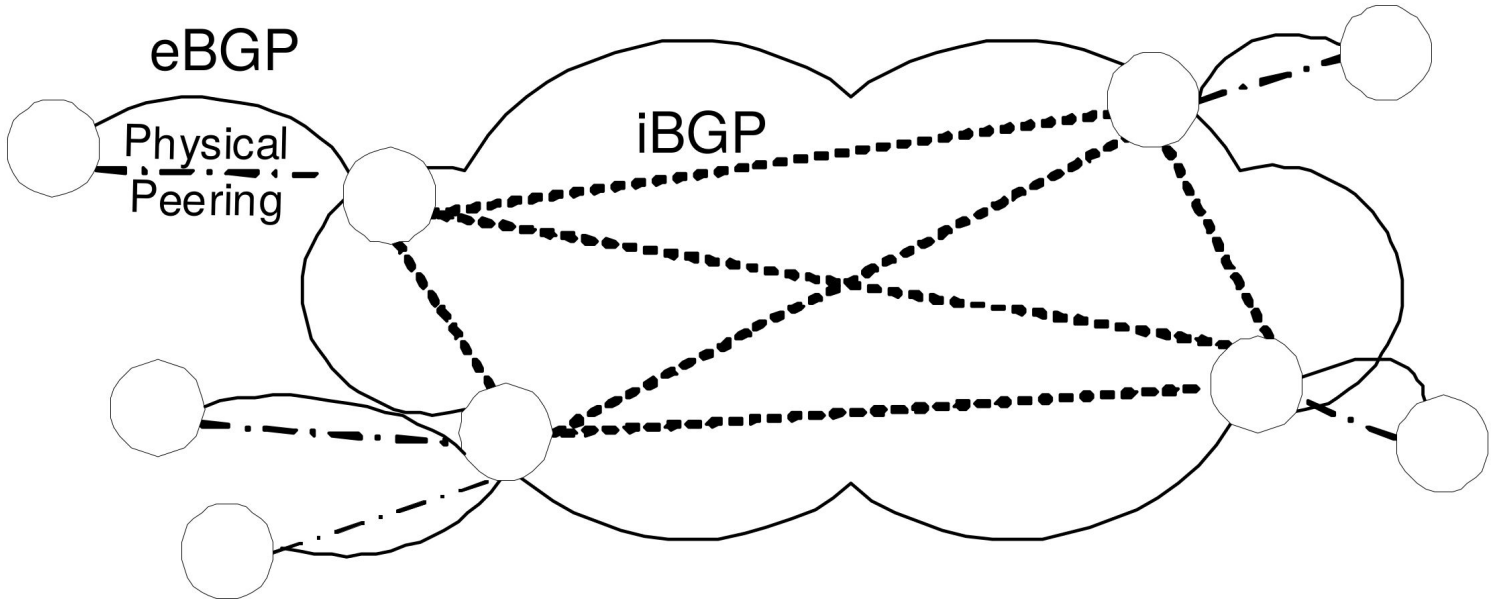


Figure 2: Operation of BGP routing inside an AS. Most small networks use a "full mesh" iBGP configuration, where every router in the AS has an iBGP session to every other router.

RCP (2004)

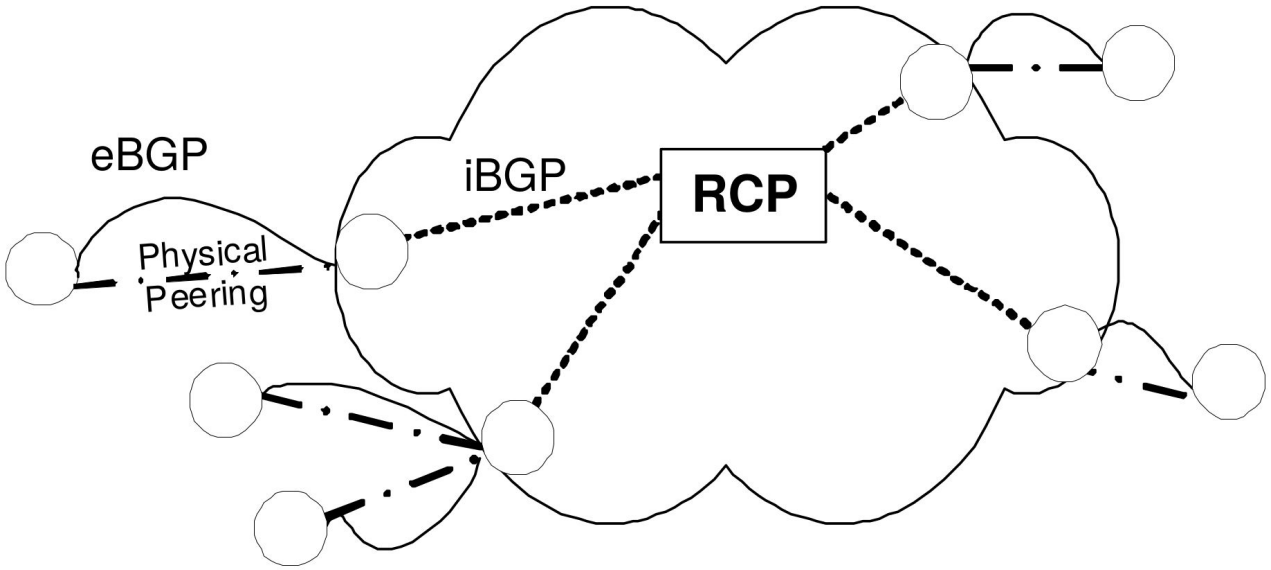


Figure 4: The first phase replaces the pairwise iBGP sessions between routers with iBGP sessions to RCP. RCP uses knowledge about the IGP topology and the best routes from each border router to make routing decisions on behalf of each router. RCP distributes the path assignment to the routers via iBGP.

RCP (2004)

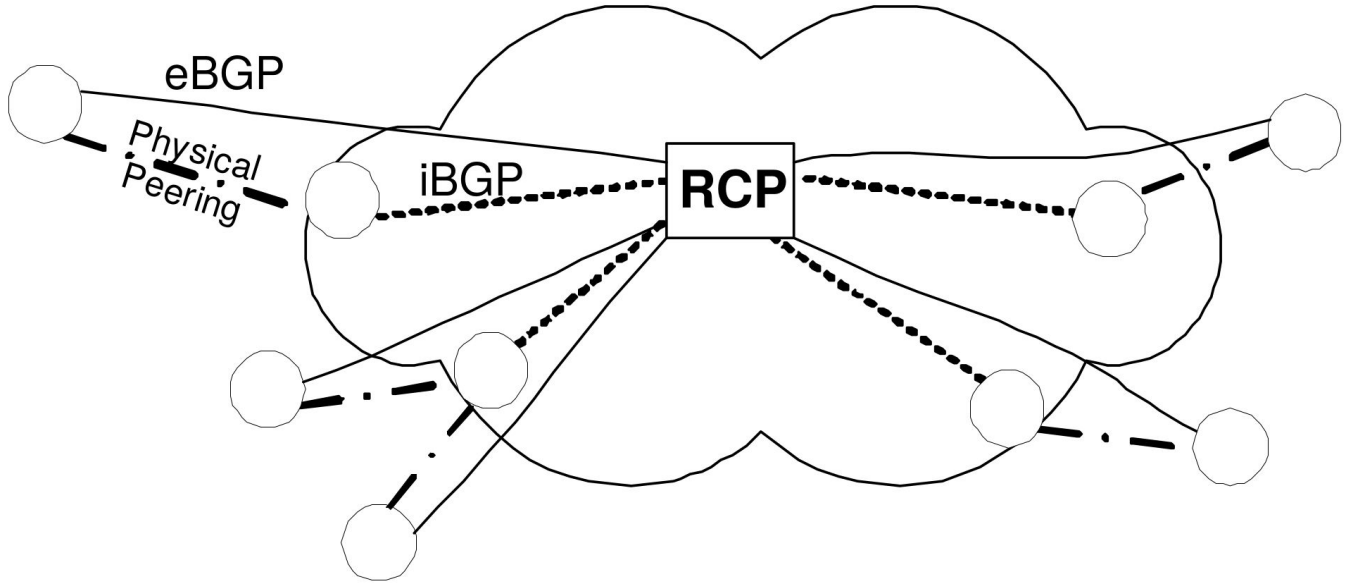
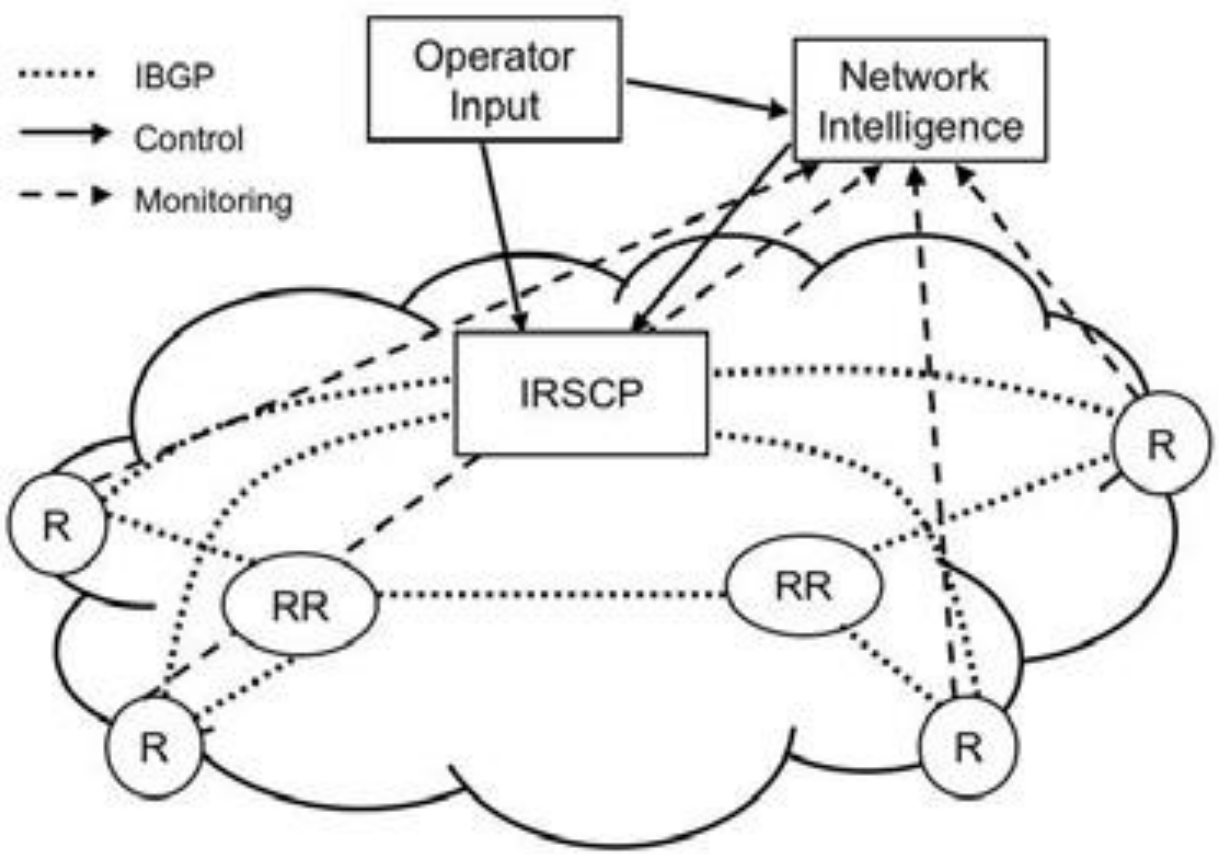
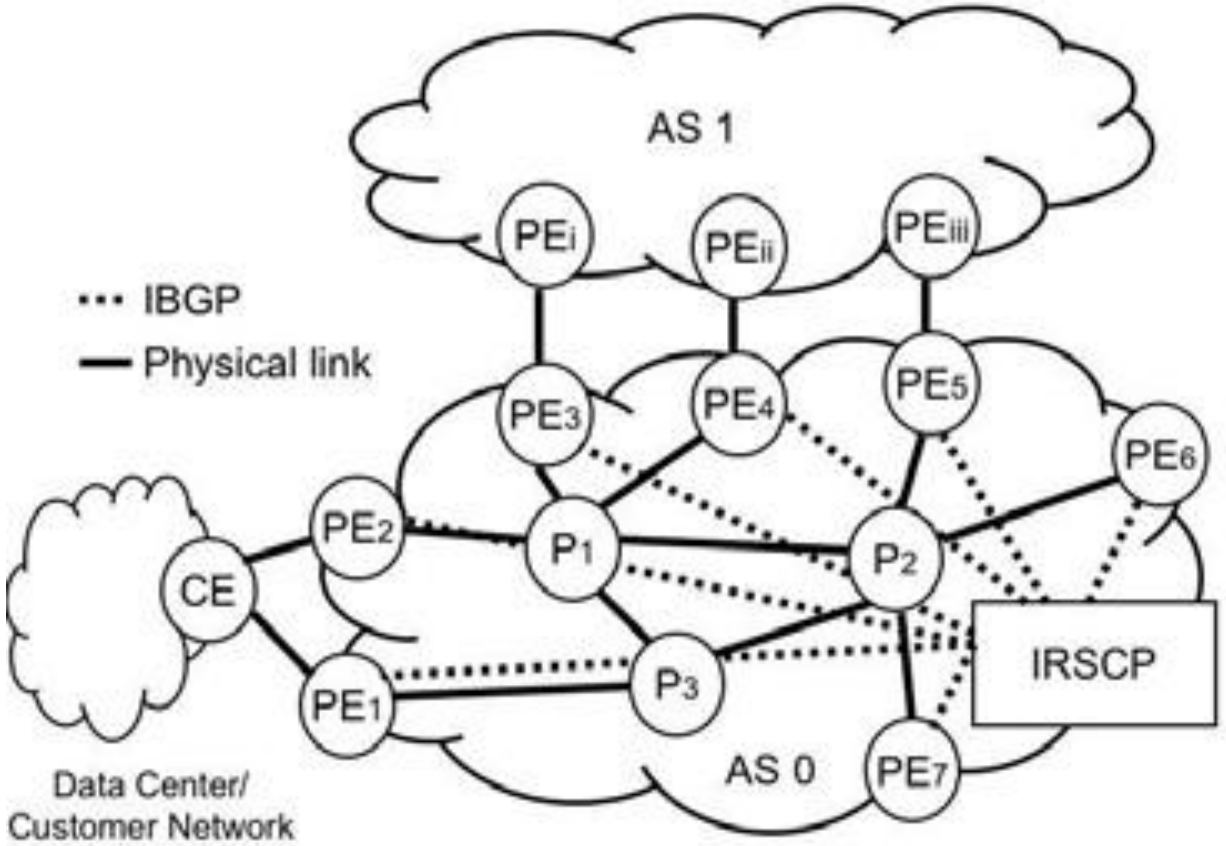


Figure 5: The second deployment phase of RCP operates in a similar manner as the first phase, but now RCP itself has eBGP sessions to routers in other ASes, rather than relying on border routers to learn routes from other ASes and apply local policies.

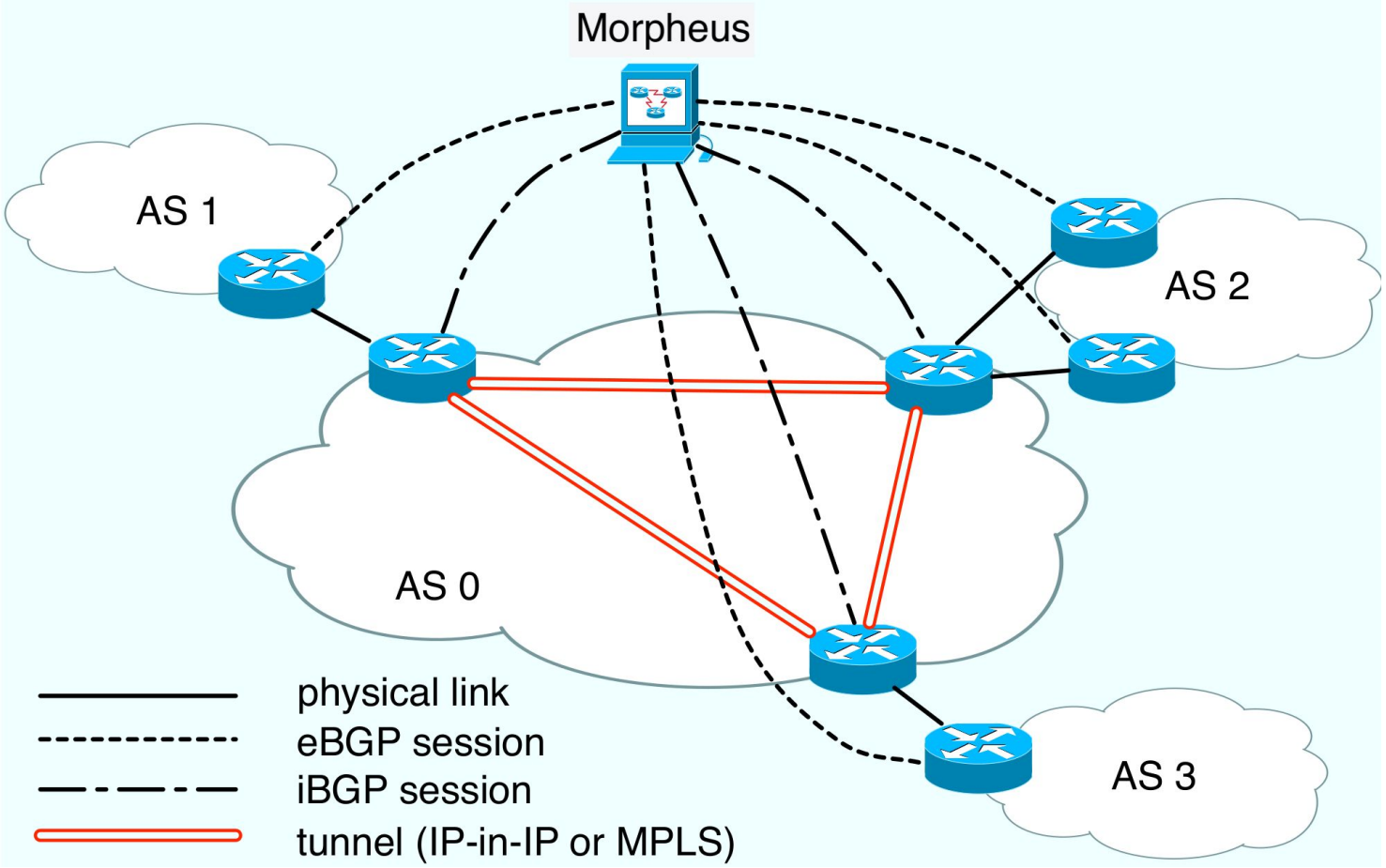
IRSCP (2007)


IBGP
Control
Monitoring
Operator Input
Network Intelligence
IRSCP
R
R
RR
RR
R
R

IRSCP (2007)


AS 1
PEi
PEii
PEiii
IBGP
Physical link
PE3
PE4
PE5
PE6
PE2
P1
P2
CE
IRSCP
PE1
P3
AS 0
PE7
Data Center/
Customer Network

Morpheus (2007)



PIR

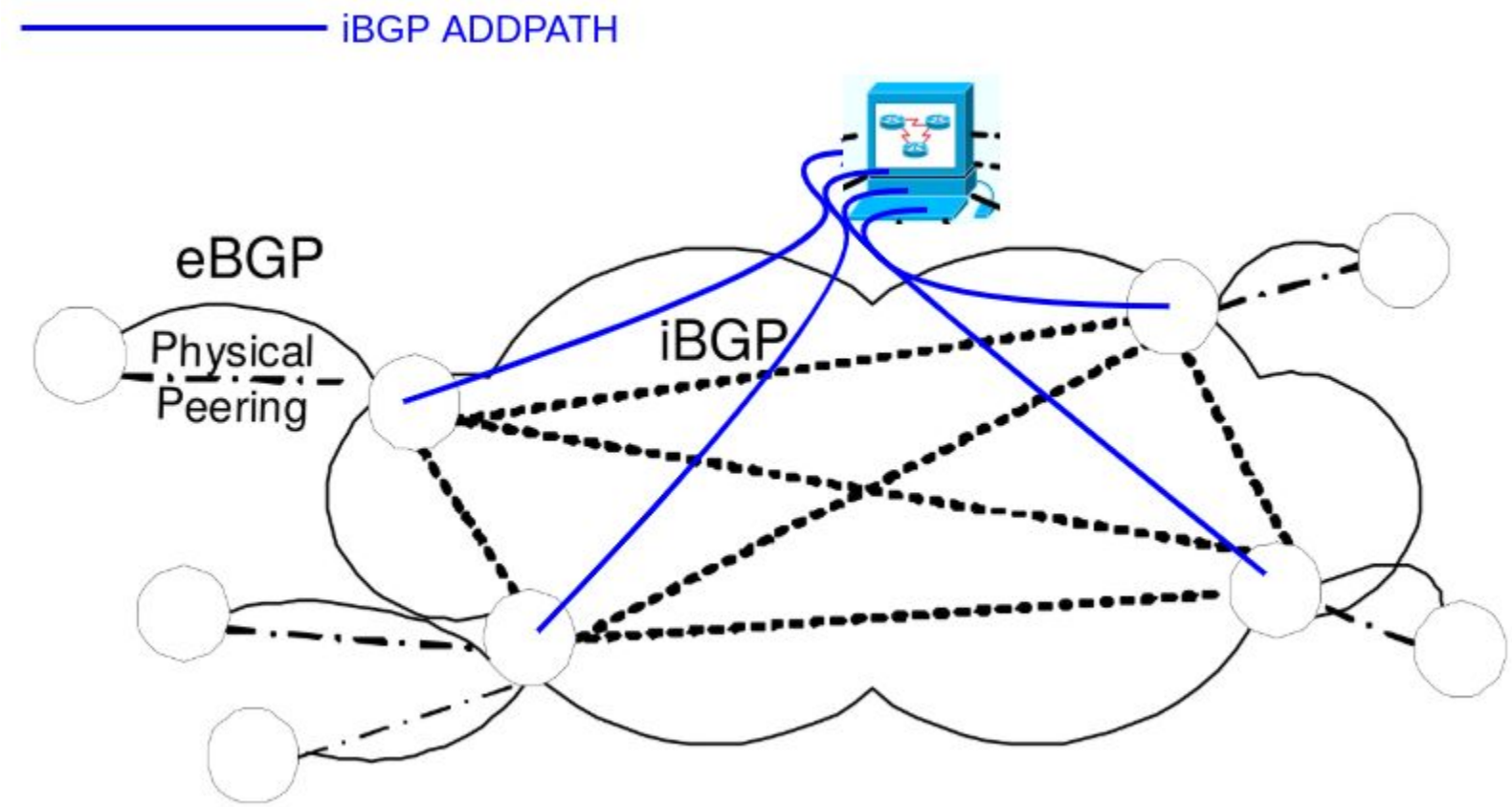
Problem Statement

1. How to get external routing state
   a. non-intrusively
   b. reliably
   c. quickly
   d. completely
2. How to implement / enforce override
   a. non-intrusively
   b. reliably
   c. quickly

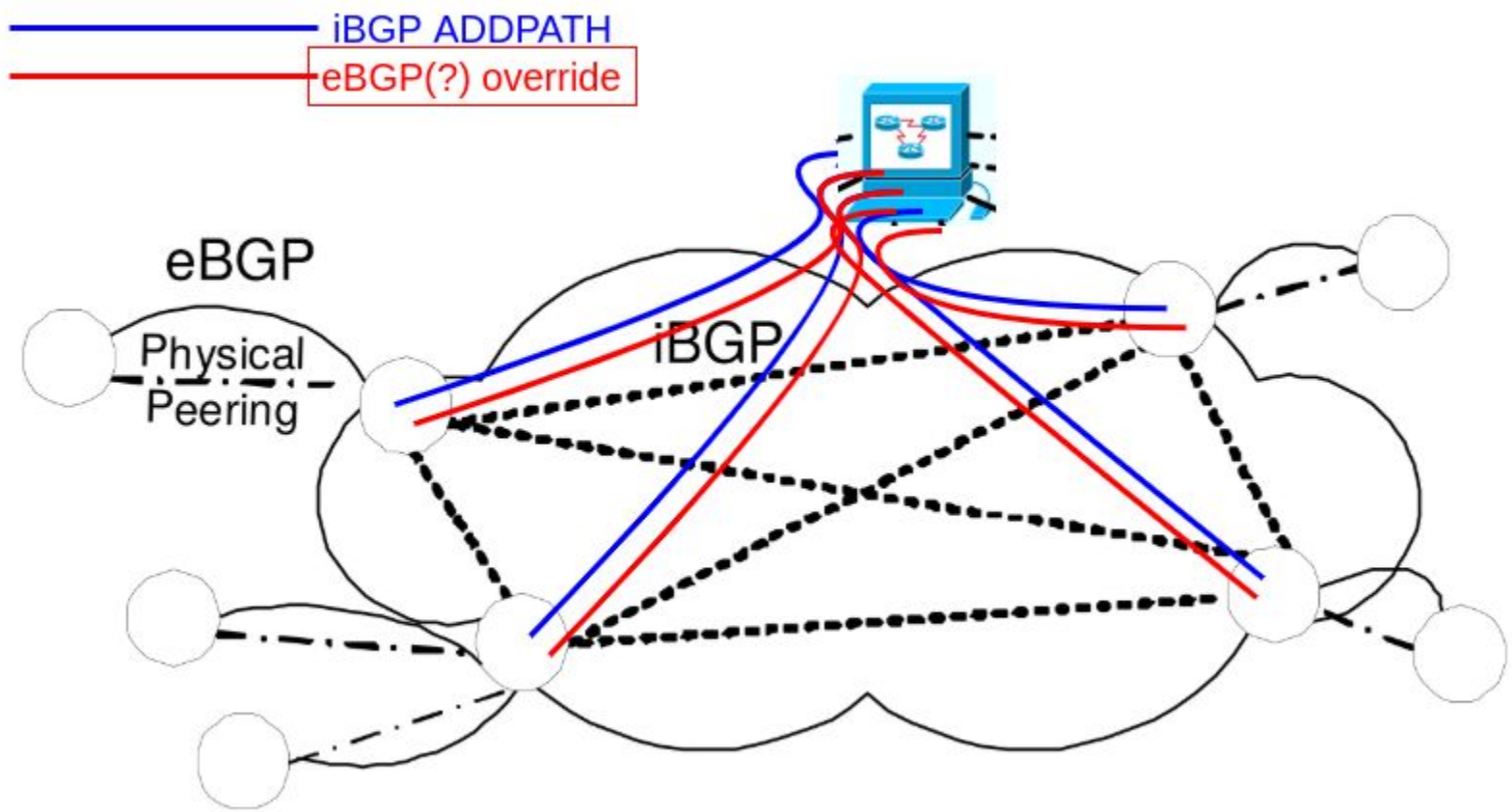
PIR strategy

1. How to get external routing state
   a. ADDPATH
   b. not BMP because not reliable
2. How to implement / enforce override
   a. pick the 2nd best route
   b. announce it with higher preference
      i. (or eBGP as a preferred peer)
   c. thought a lot about ‘route poisoning’ BGP extensions - couldn’t make it work...

PIR (2020)



PIR (2020)



Request for Comment

- I’m new to ietf - so the means of interaction is also something I need advice about
- To my knowledge there is little current deployment of online programmable routing control in the Internet.
  - PLEASE SHOUT OUT ANY EXCEPTIONS!
- My request - please comment on these ideas
  - are there any examples of deployments or attempts to deploy anything similar (and yes I have heard of Noction!)
- This is a request for feedback, sense checking, advice and support resources
  - (mostly just anonymised BGP configurations and current transit ISP topology, dimension, scale and routing load data).
  - contact email: **n.p.hart@lancaster.ac.uk**