

Building interdomain traffic engineering tools



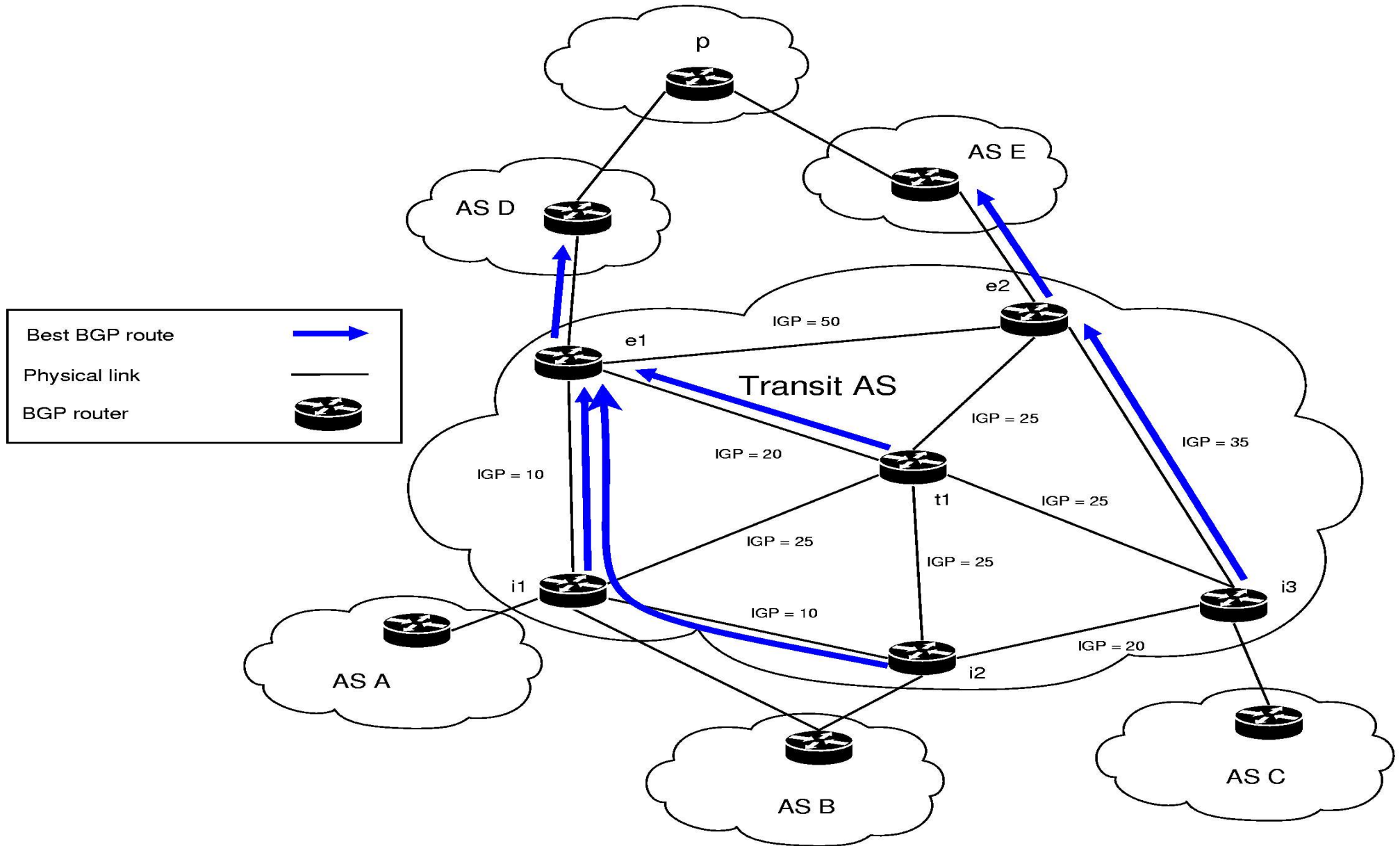
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Context



State-of-the-art

- **Large-scale event-driven simulators:**
 - **SSFNet**
 - **JSim**
- **Route prediction:**
 - **CBGP**
 - **RCP**

CBGP

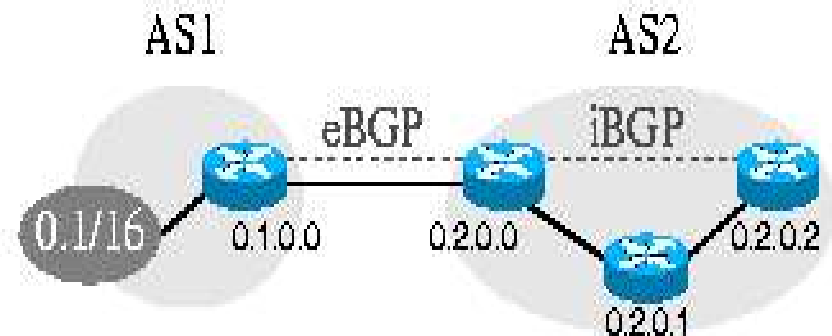
- **An efficient open-source BGP simulator written by Bruno Quoitin**
 - <http://cbgp.info.ucl.ac.be>
- **Key features**
 - allows to model large network topologies
 - allows to reproduce BGP routing policies such as
 - import and export filters, communities,...
 - Perl and Python interfaces for interacting with CBGP
- **Part of the TOTEM TE toolbox**
(<http://totem.info.ucl.ac.be>)

CBGP config example

```
# Setup BGP in router 0.1.0.0
bgp add router 1 0.1.0.0
bgp router 0.1.0.0
add network 0.1/16
add peer 2 0.2.0.0
peer 0.2.0.0 up
```

```
# Setup BGP in router 0.2.0.0
bgp add router 2 0.2.0.0
bgp router 0.2.0.0
add peer 1 0.1.0.0
peer 0.1.0.0 next-hop-self
add peer 2 0.2.0.2
peer 0.1.0.0 up
peer 0.2.0.0 up
```

```
# Setup BGP in router 0.2.0.2
bgp add router 2 0.2.0.2
bgp router 0.2.0.2
add peer 2 0.2.0.0
peer 0.2.0.0 up
```



TE over CBGP (1)

- **TE tool collects**
 - **IGP information for topology (e.g. pyrt)**
 - **BGP routes (e.g. zebra)**
 - **Traffic statistics (e.g. netflow)**
- **TE tool**
 - **changes IGP weights inside CBGP**
 - **injects eBGP update messages inside CBGP**
 - **keeps traffic info up to date**

TE over CBGP (2)

- **Based on traffic engineering objectives, TE tool determines the BGP route to be advertised to each border router via iBGP**
 - **by sending different BGP UPDATES for each important prefix to each ingress routers, TE tool can influence the flow of the IP traffic**
 - **ingress routers send transit traffic inside tunnels (MPLS, GRE, ...) to egress routers or TE tool ensures consistency in IP forwarding if no tunnels are used**

CBGP case studies

- **Case studies performed up to now:**
 - **tweaking iBGP to limit impact of peering failure on traffic matrix**
 - **assessing impact of internal link and router failures on best route choice inside the AS**
 - **optimizing (on-line) a cost function defined on outbound traffic of a stub AS**
 - **computation of interdomain MPLS LSPs in PCE's**

Purpose of interdomain TE ?

(for ISPs)

- **reduce congestion**
- **reduce costs**
- **improve delays**
- **better load-balance traffic**
- **improve network robustness**
- **make TM more stable**
- **...**

Open questions

(for ISPs)

- **Is congestion on peering links important ?**
- **Do we need online or offline TE solutions ?**
- **Do we need to optimise for delay ?**
- **Do we need to optimise for bandwidth ?**
- **Is multipath routing useful ?**
- **Do we need interdomain MPLS ?**
- **Do we need new policies ?**

Open questions

(for ISPs)

- **Do we need to quickly reroute in case of failures ?
If yes, how fast ?**
- **Billing issues ?**
- **What about interdomain QoS ?**

Relevance of interdomain TE

- **Does someone really care about it ? or is it just about research ?**
- **Is interdomain TE aimed at providing solutions to operational problems or just architectural guidelines ?**
- **Is interdomain TE relevant for interdomain architecture at all ?**