MPLS Traffic Engineering across AS boundaries

CENSORED

Cristel Pelsser

cpe@info.ucl.ac.be

Université Catholique de Louvain

Belgium

Agenda

- Problem statement
- Constrained intra-AS path computation
- Current inter-AS routing
- Proposal for constrained inter-AS path computa-tion
- Remaining issues

Problem statement

- Use of MPLS across AS boundaries
    - VPNs
    - Faster recovery than with BGP
    - QoS
- Requirements are formulated at the IETF
    - ccamp (a lot of new drafts planned)
- Protocol extensions to RSVP -TE already proposed at the IETF
    - Establishment of inter-AS LSPs
    (`draft-pelsser-rsvp-te-interdomain-lsp-00.txt`)
    - Protection of inter-AS LSPs
    (`draft-decnodder-mpls-interas-protection-01.txt`)
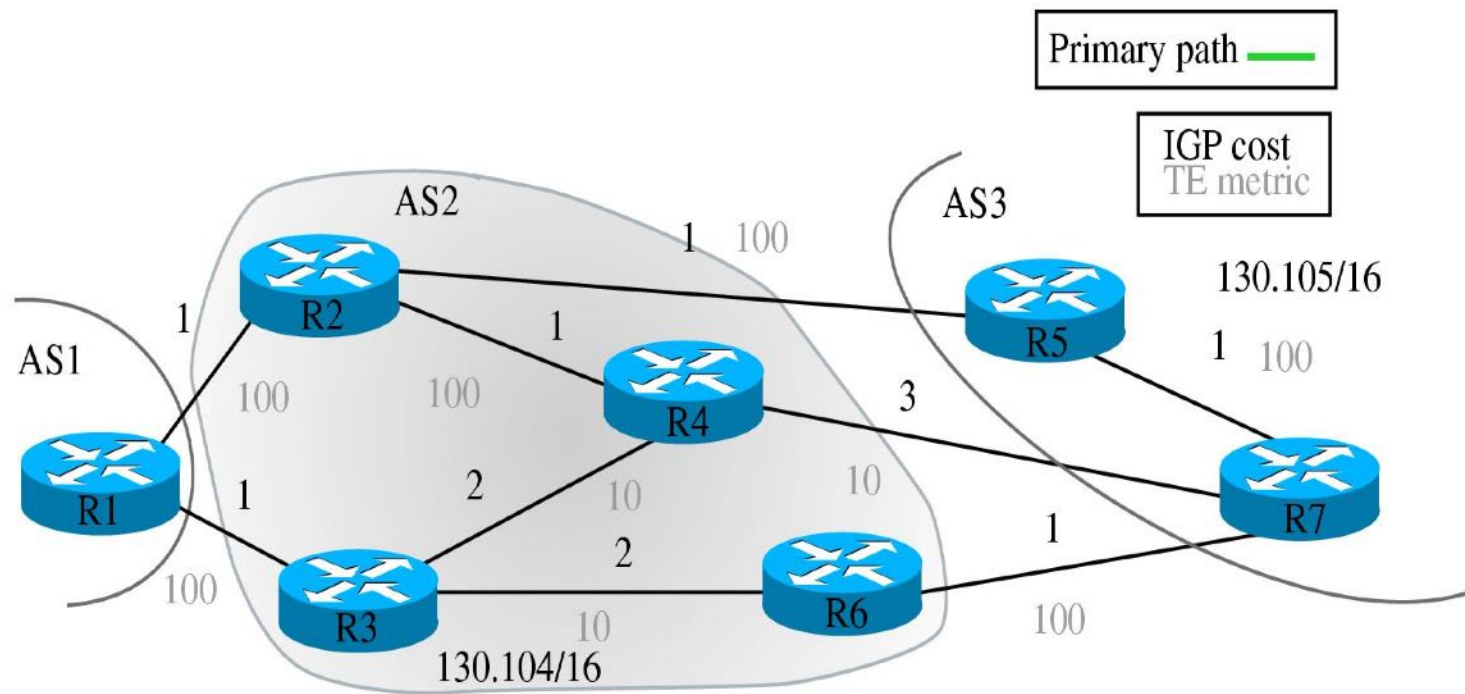
Constrained intra-AS path computation

- **Each node** possesses the complete topology of its AS (No areas)
  - Link info:
    - IGP cost
    - TE info with OSPF-TE or IS-IS TE

Link	Cost	TE metric
R1–R2	1	100
R1–R3	1	100
R2–R4	1	100
R2–R5	1	100
R3–R4	2	10
R3–R6	2	10
R4–R7	3	10
R5–R7	1	100
R6–R7	1	100
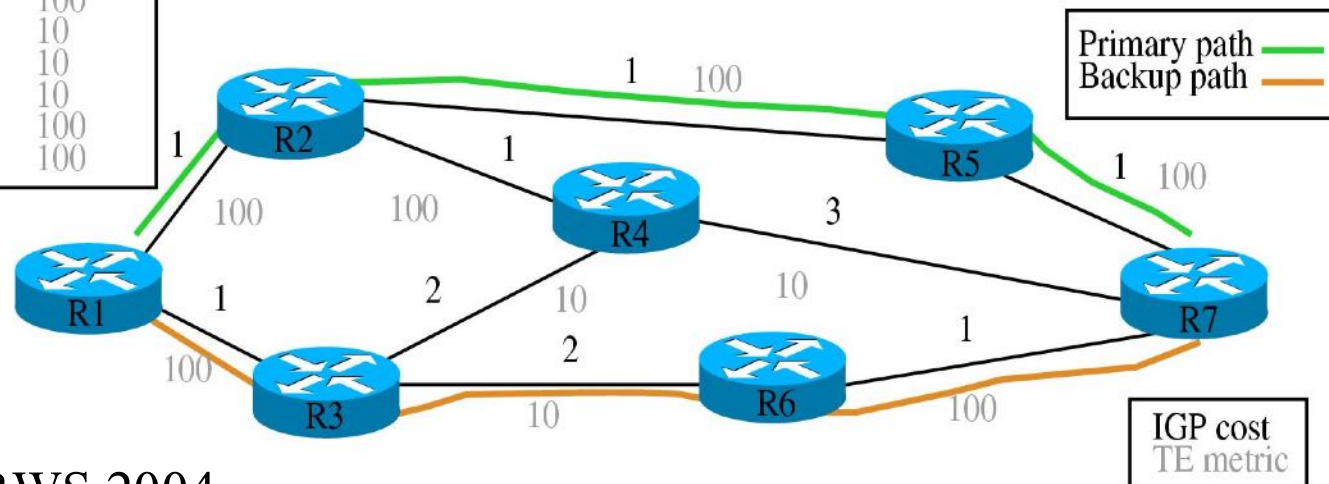
Primary path —
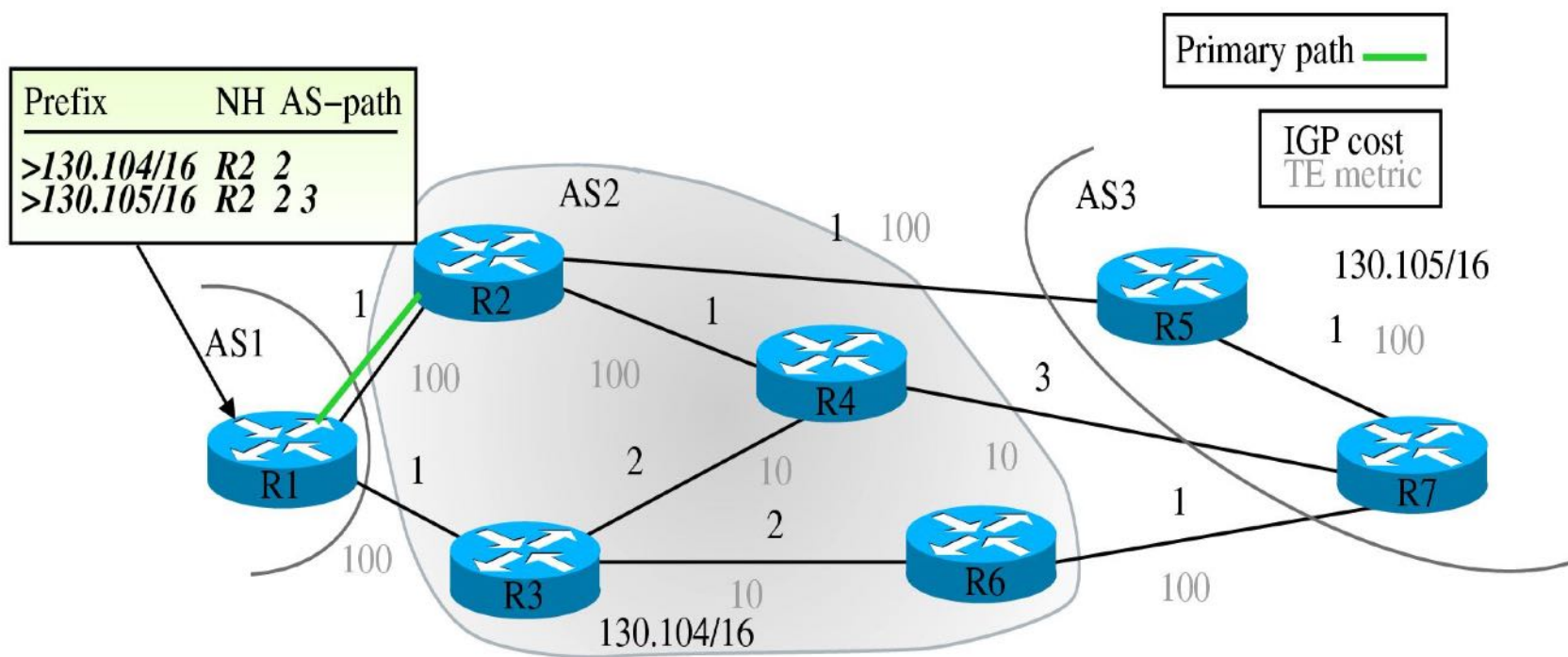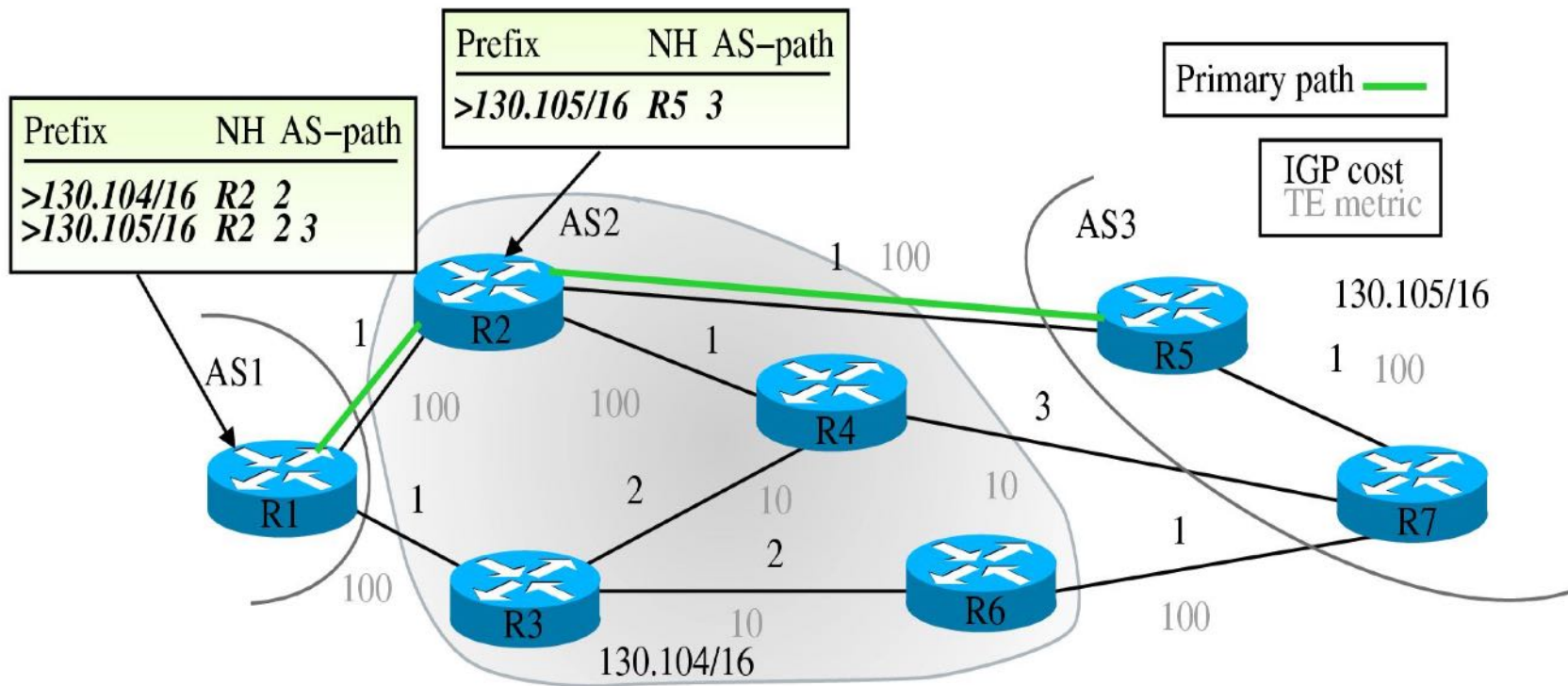Backup path —

IGP cost
TE metric

C. Pelsser - IDRWS 2004

Current inter-AS routing (BGP)

- The nodes only possess **reachability information** for prefixes outside the AS

Current inter-AS routing (BGP)

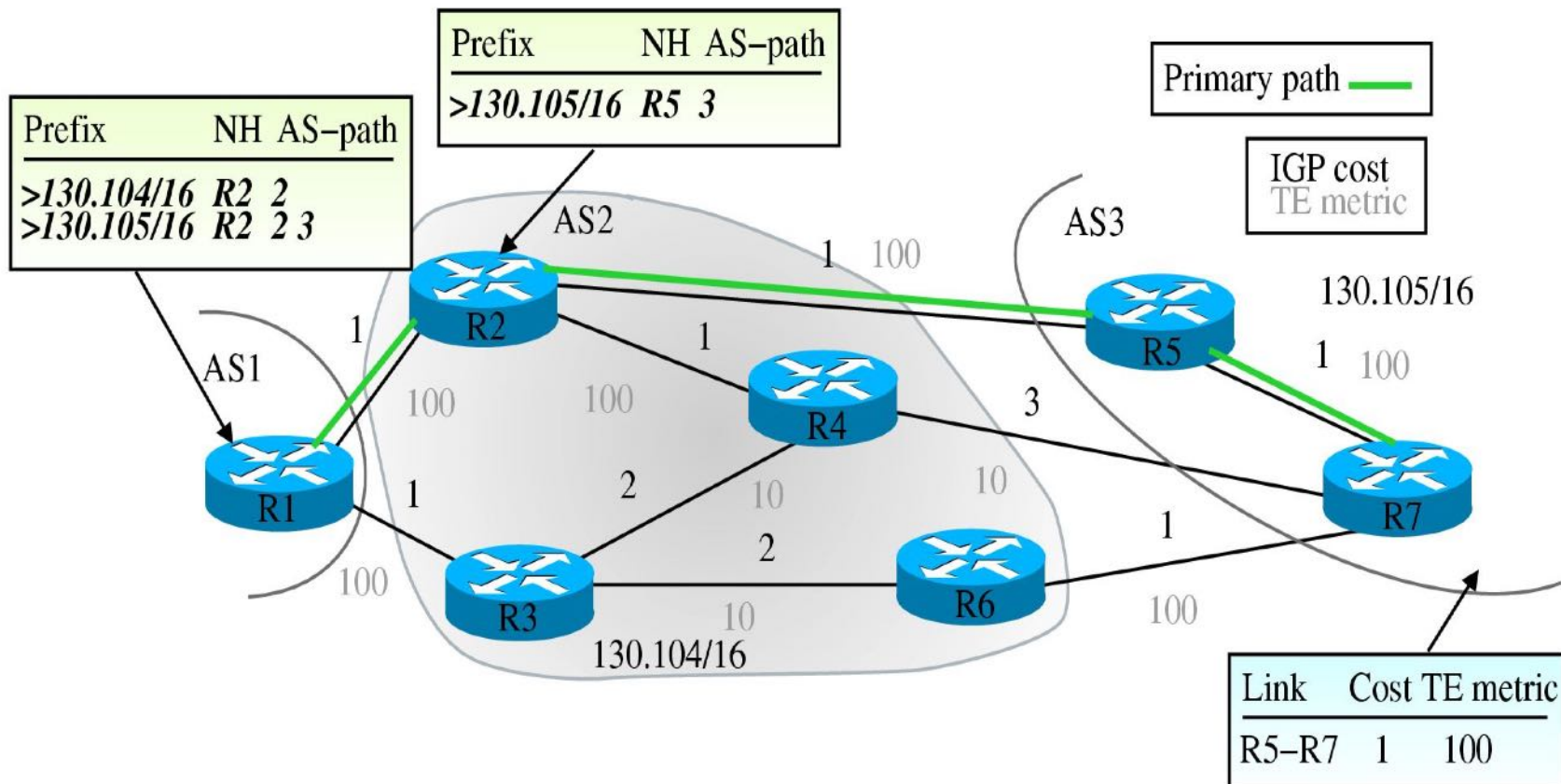◆ The nodes only possess **reachability information** for prefixes outside the AS
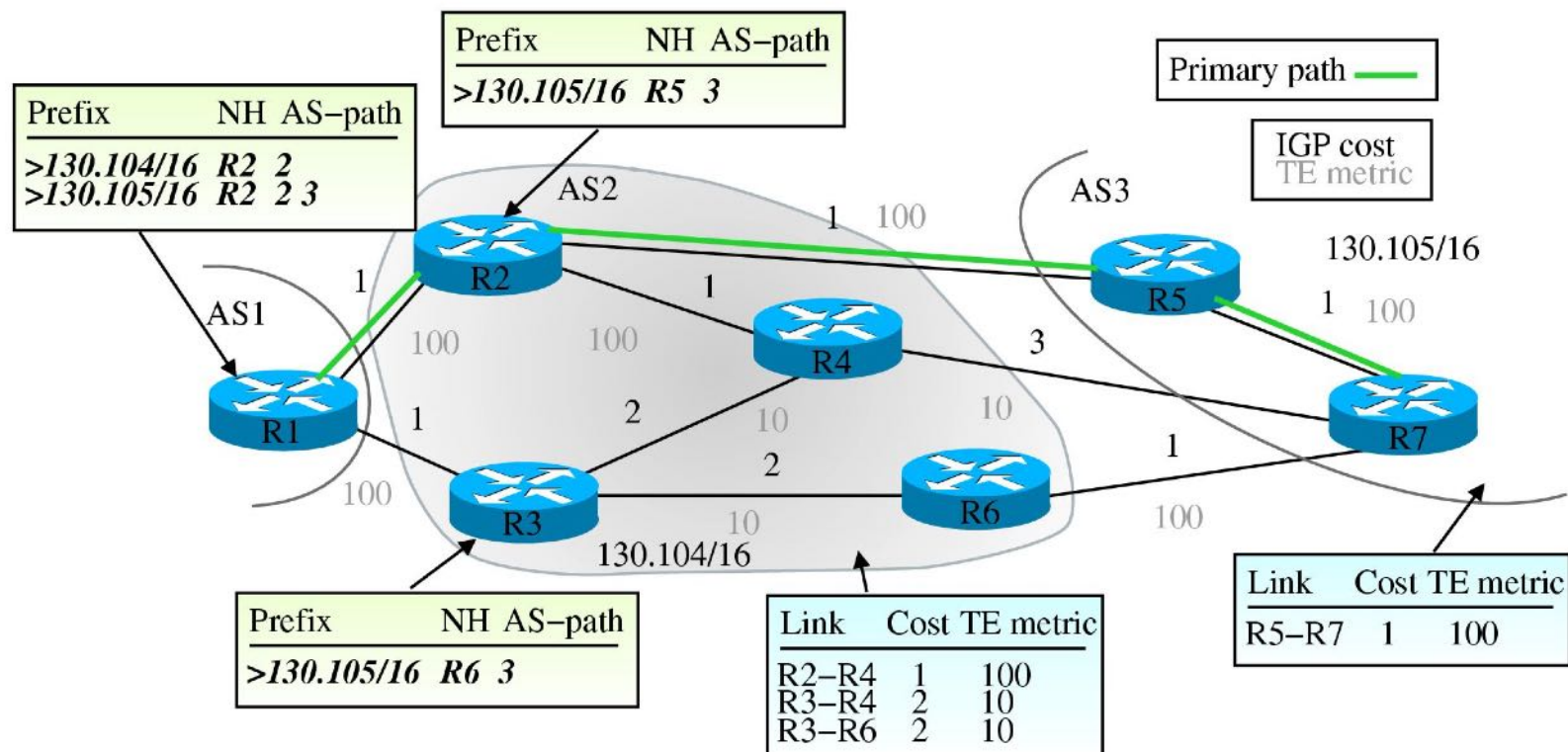
Current inter-AS routing (BGP)

- The nodes only possess **reachability information** for prefixes outside the AS
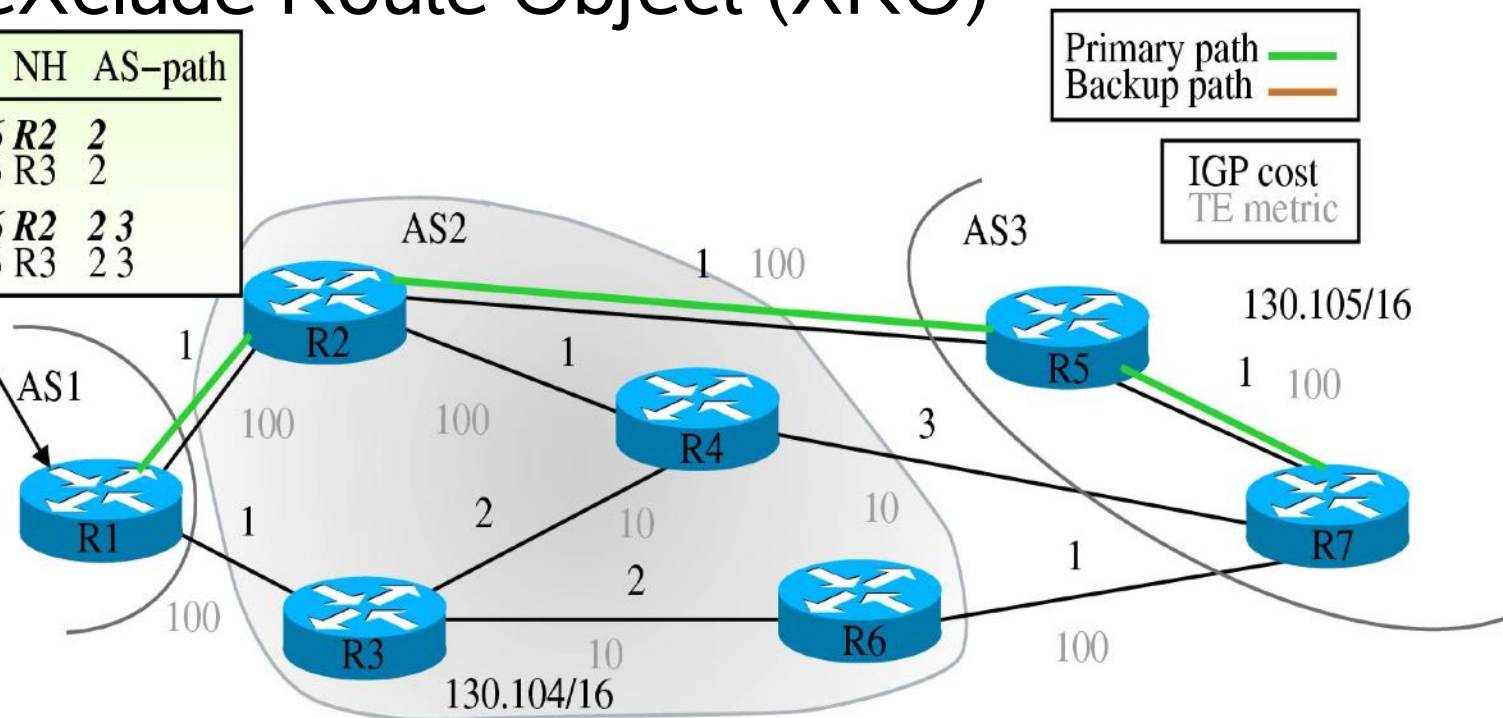
Current inter-AS routing (BGP)

- The nodes only possess **reachability information** for prefixes outside the AS

Current inter-AS routing (BGP)

- The nodes only possess **reachability information** for prefixes outside the AS
- Alternate path through R3 never used

Constrained inter-AS path computation : Proposal

- Compute disjoint path based on **local** Adj-RIB-In and eXclude Route Object (XRO)
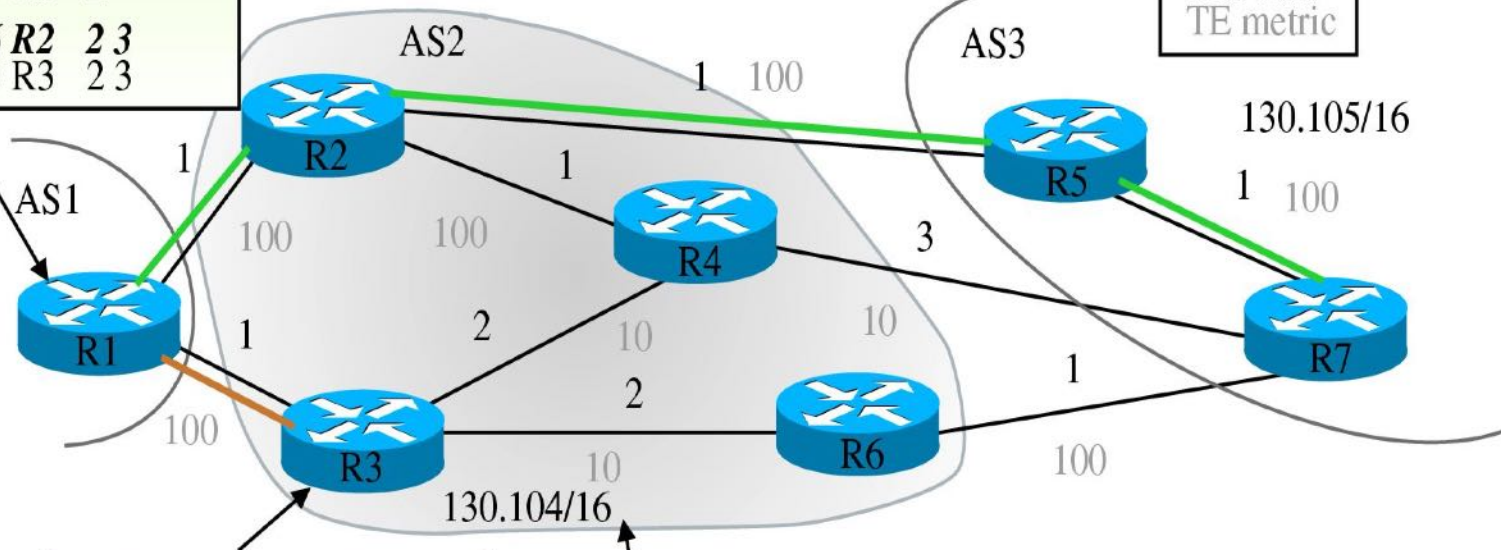
Constrained inter-AS path computation : Proposal

- Compute disjoint path based on **local** Adj-RIB-In and eXclude Route Object (XRO)

Constrained inter-AS path computation : Proposal

- Compute disjoint path based on **local** Adj-RIB-In and eXclude Route Object (XRO)

Constrained inter-AS path computation : Proposal

◆ Compute disjoint path based on **local** Adj-RIB-In and eXclude Route Object (XRO)

Preliminary results

- Topology with :
  - 20 transits composed of 50 nodes
  - 190 stubs (all possible combinations of dual-homed stubs)
- Customer-provider policies between transit and stubs
- Constraint : node protection
- Optimise end-2-end cost (ex: delay)
- Backtracking (cranckback) when no path available for the required constraint
- No incremental establishment of LSPs
  - available resources are not updated after each LSP establishment

Preliminary results

Comparison CSPF and BGP primary LSPs

C. Pelsser - IDRWS 2004

Preliminary results

Comparison CSPF and BGP backup LSPs

C. Pelsser - IDRWS 2004
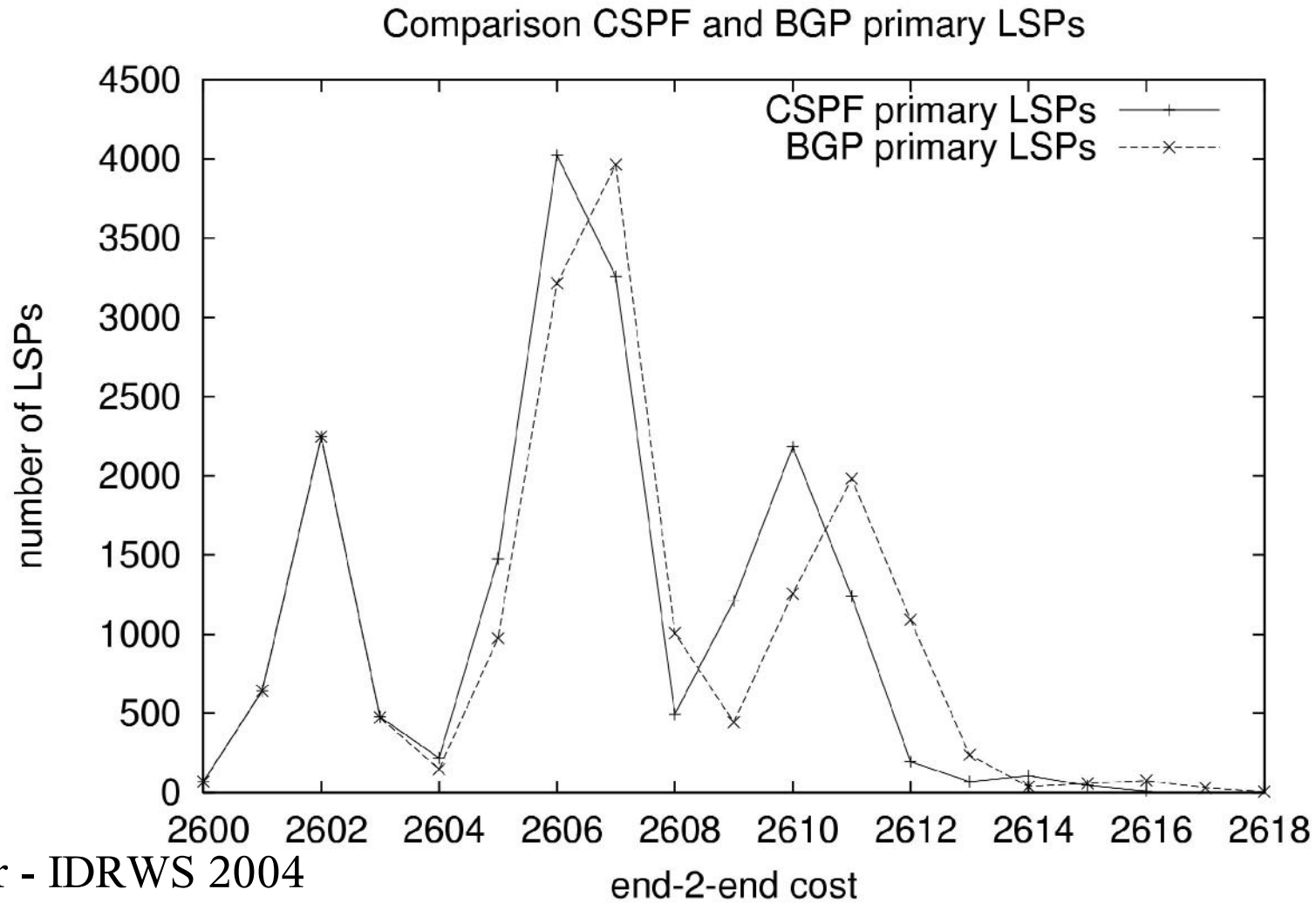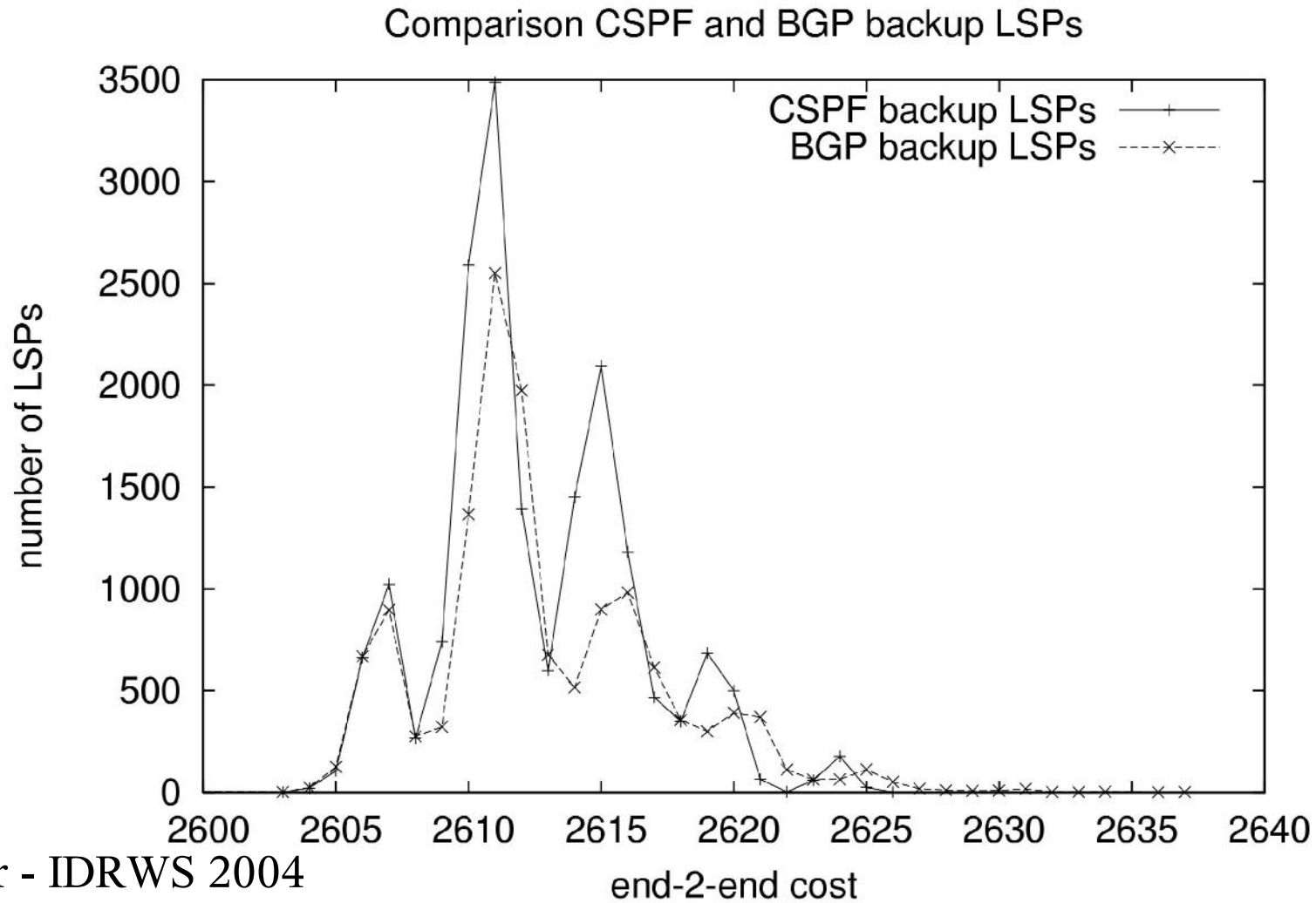
Remaining issues

- Work on heuristics for the choice of alternative next-hops (NH)
- All possible NH are not necessarily in the Adj-RIB-In of the local router
  Full-mesh of iBGP session:
  - All routers only know the best route selected by the other routers in the iBGP mesh
  Route-Reflectors (RR):
  - Clients only know the route selected by their RR
  - The RR should make the choice for its clients
- Work on link-state inter-AS routing protocols?

Conclusion

- **Distributed** disjoint path computation possible based on
  - Adj-RIB-Ins

  and
  - eXclude Route Object (XRO)
    (`draft-ietf-ccamp-rsvp-te-exclude-route-01.txt`)
- Applicable for
  - Protection, load-balancing and TE
    - The ISPs can choose the AS-path (difficult with BGP)
  - Establishement of **constrained** inter-AS primary LSP
    - bandwidth, delay, link affinities constraints