



Internet Topology Generation for Large Scale BGP Simulation

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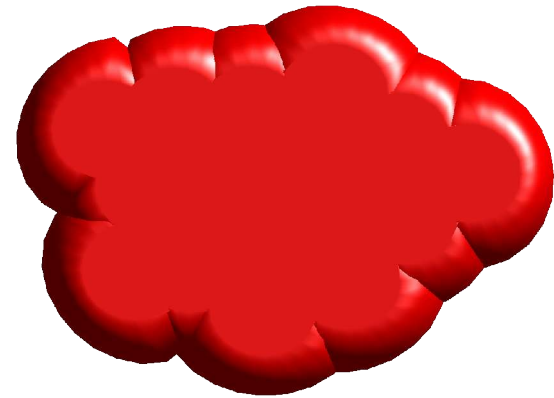
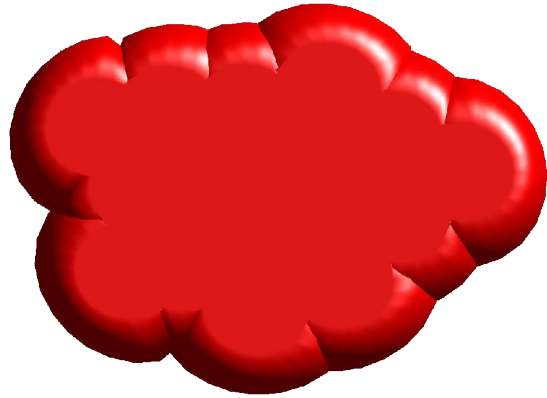
Outlook

- BGP: Border Gateway Protocol
- Large Scale Simulation: motivations
- Large Scale BGP Simulation Model
 - Realistic Topologies Generation
- Conclusion and future works

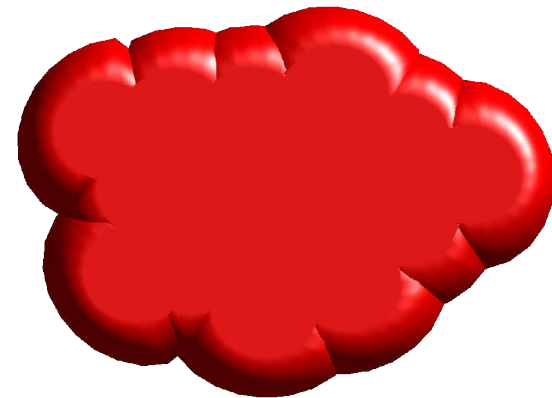
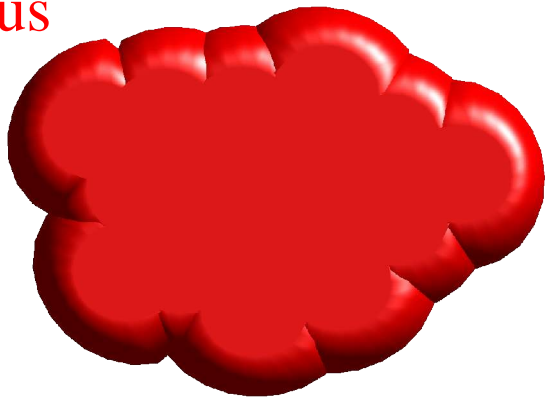
BGP, Interdomain Routing Protocol

- Internet Routing Hierarchy
- Interdomain routing protocol : BGP
- BGP routing domains: Autonomous System (AS)
- Messages exchange between AS: routes announcements and withdrawals
- Independent paths choice (routing policies)
- IBGP: inter-AS BGP communication

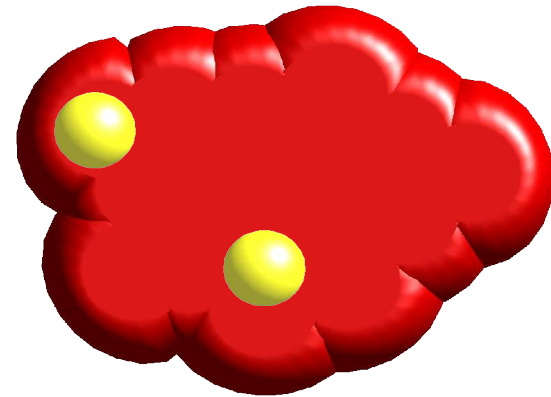
BGP Vocabulary



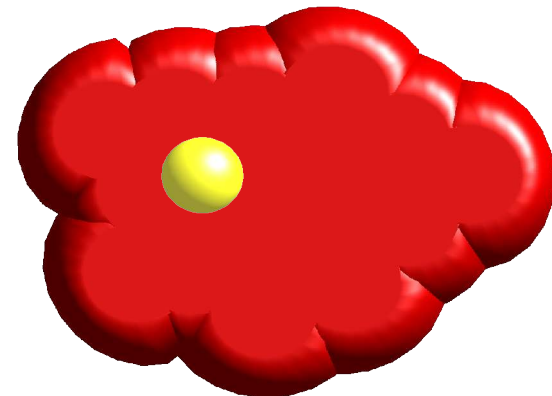
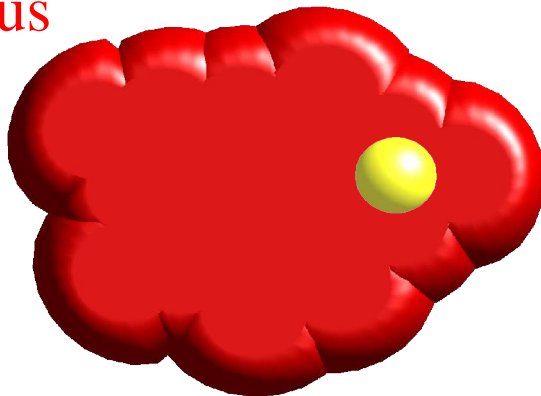
Autonomous
System



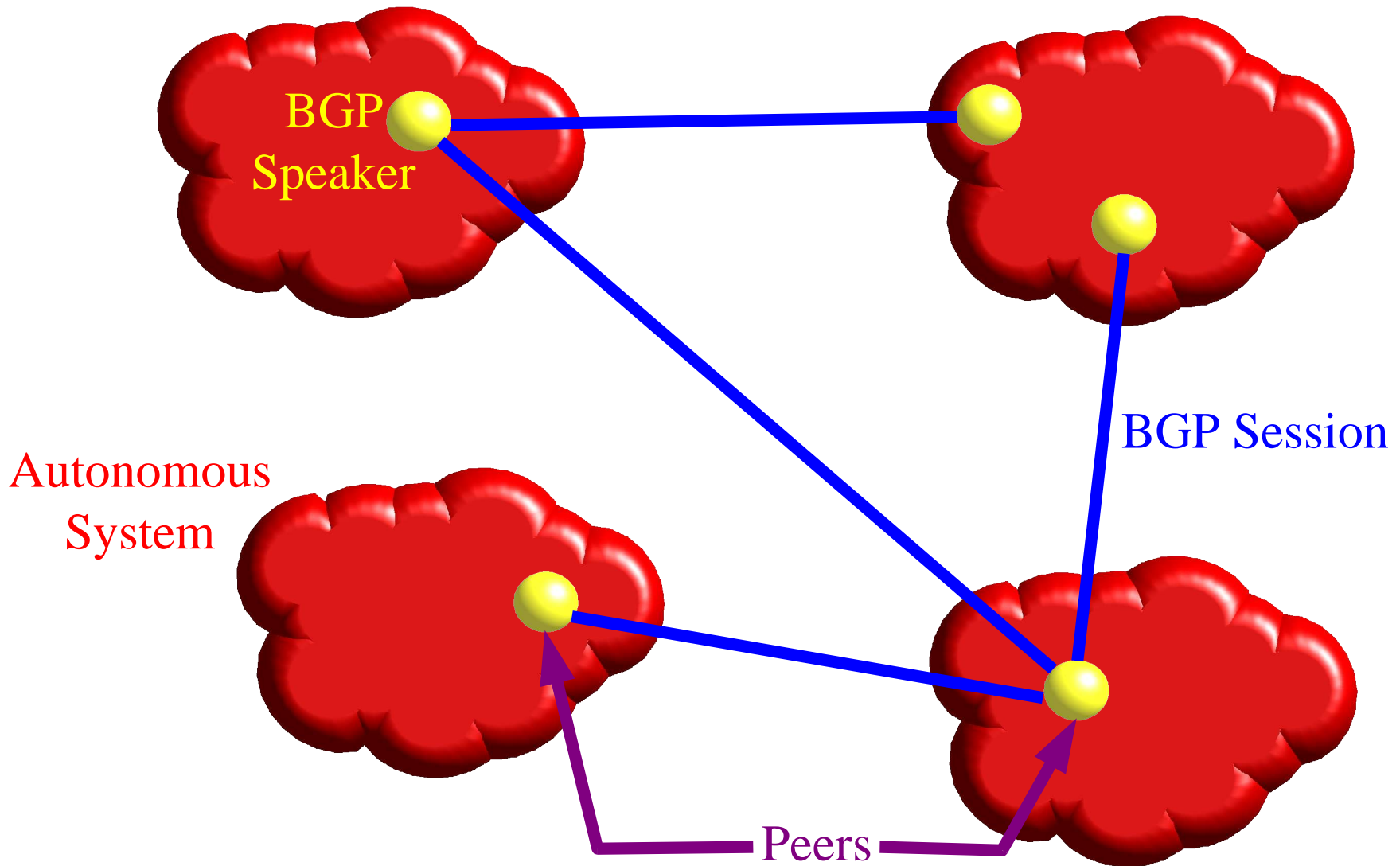
BGP Vocabulary



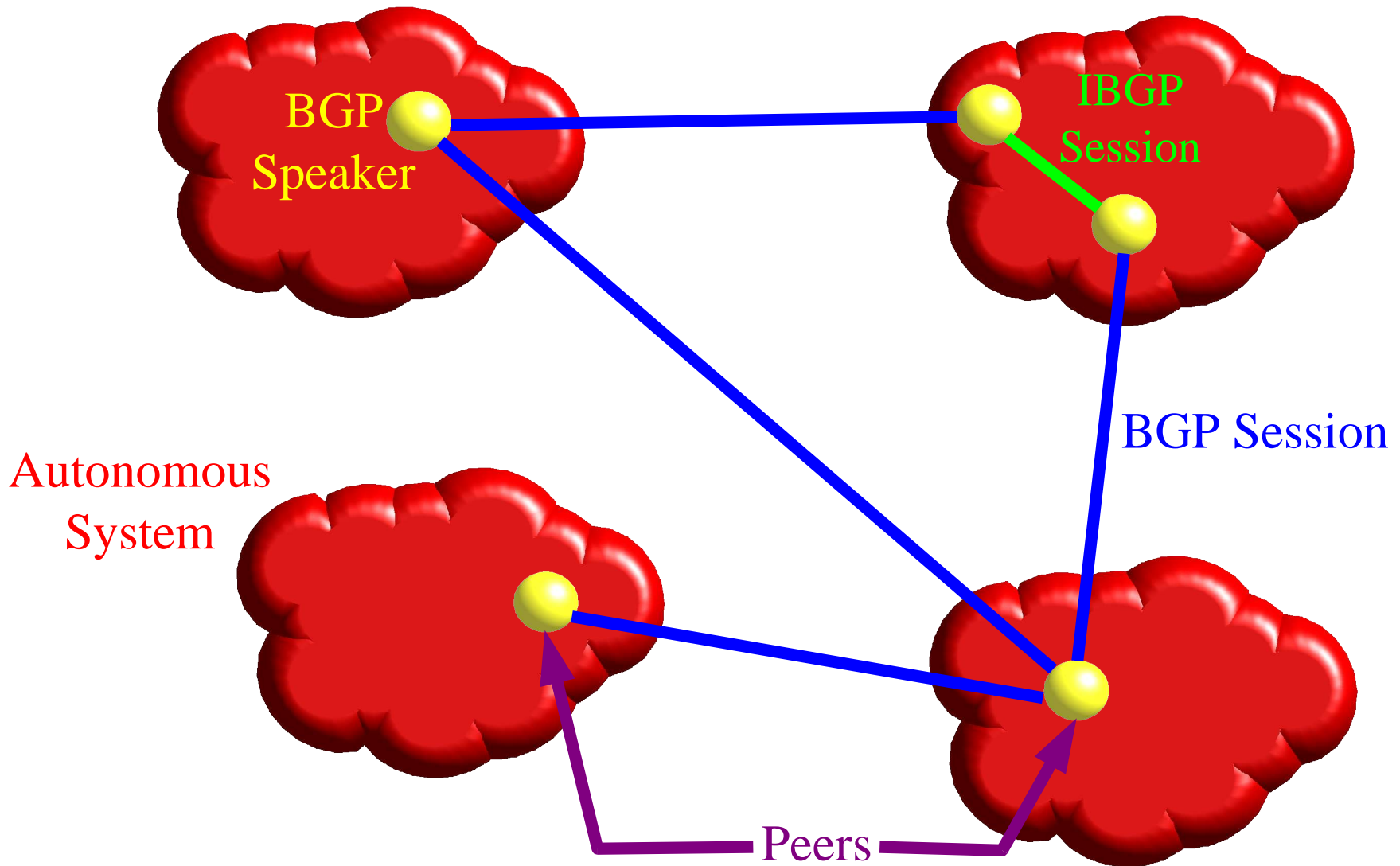
Autonomous
System



BGP Vocabulary



BGP Vocabulary



Interdomain Routing Instability

- Routing Instability: Fast changes of networks accessibility and topology information
 - BGP slow convergence (inherent)
 - Theoretical Persistent routing oscillation (observed)
 - Sensitiveness to traffic fluctuations (observed)
- May impact user traffic and routing infrastructure
- Worms (Viruses) propagation effects on BGP routing
- Need to simulate proposed interdomain solutions to validate their implementation in real world network

Why large scale Simulation ?

- Several proposed enhancements to BGP:
 - Grapevine-BGP, Ghost flushing, Consistency assertions, Root cause notification, ...
- Enhancements experiment lacks realistic constraints
- Our Goal:
 - Recreate BGP instability on simulator before trying to correct them.
 - Recreate realistic implementation conditions and execution circumstances to guarantee solutions validity

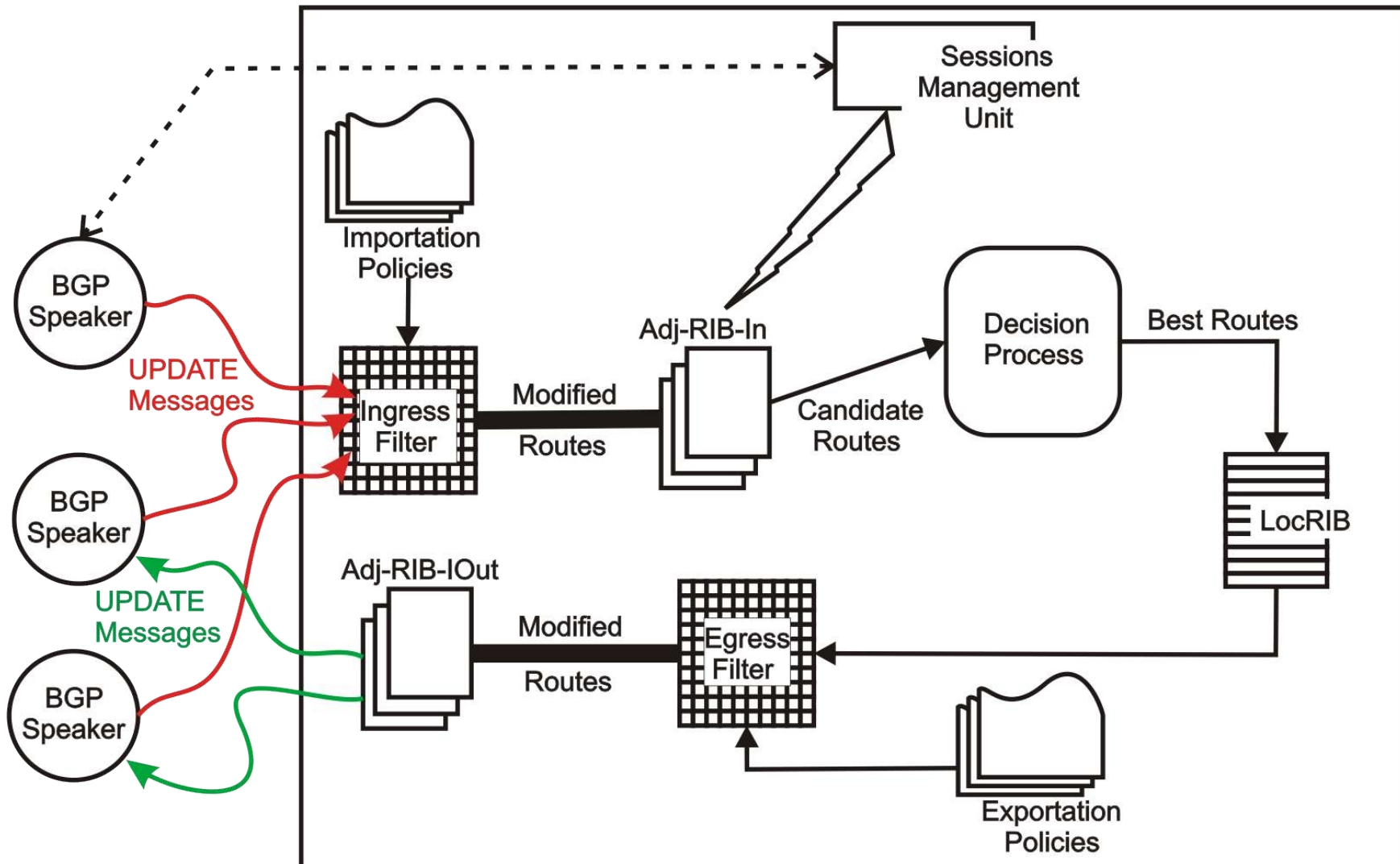
BGP Large Scale Simulation

- Creating *realistic* instabilities in the simulator:
 - Large AS Topologies
 - Topology Shape
 - Elaborate AS structure and behaviour
 - Temporal dimension: timers and messages delays
 - Traffic effects on sessions
- Produced instabilities characteristics:
 - BGP messages volume equivalent to Internet produced BGP messages volume
 - Internet comparable distribution of instability sources

BGP Large Scale Simulation Model

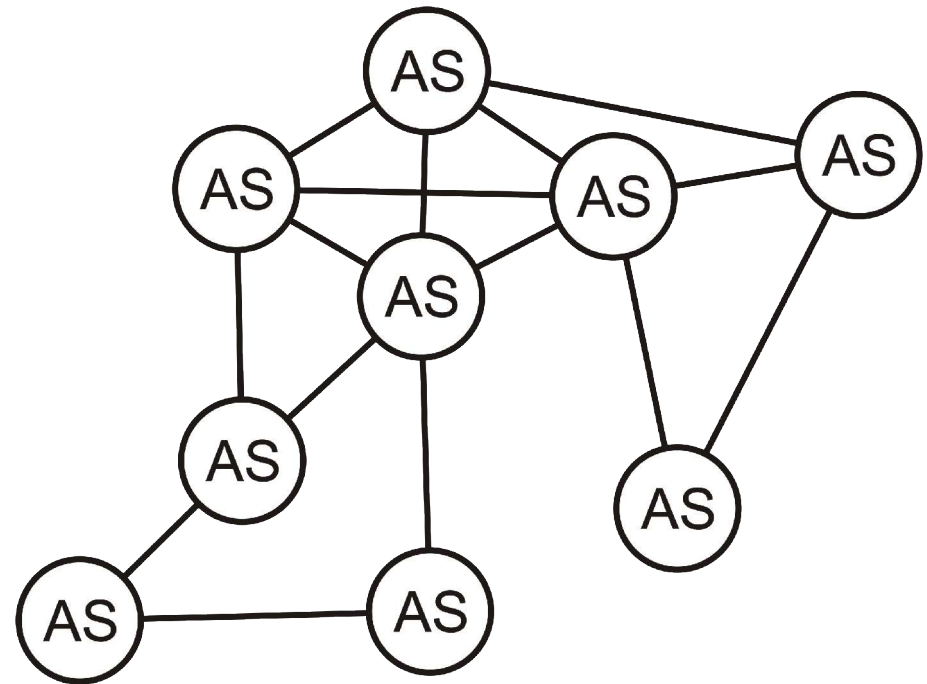
- Proposed simulation model for realistic BGP instability generation.
- Model components:
 - BGP Speaker Model: specification abstraction
 - Simulation Topology Model: Large scale BGP Sessions Topologies
 - AS Model: Sessions Topology requires complex AS interior
 - Routing Policies: chosen policies & implementation
 - Message Delays: Simulations Temporal Dimension

BGP Simulation Model: BGP Speaker



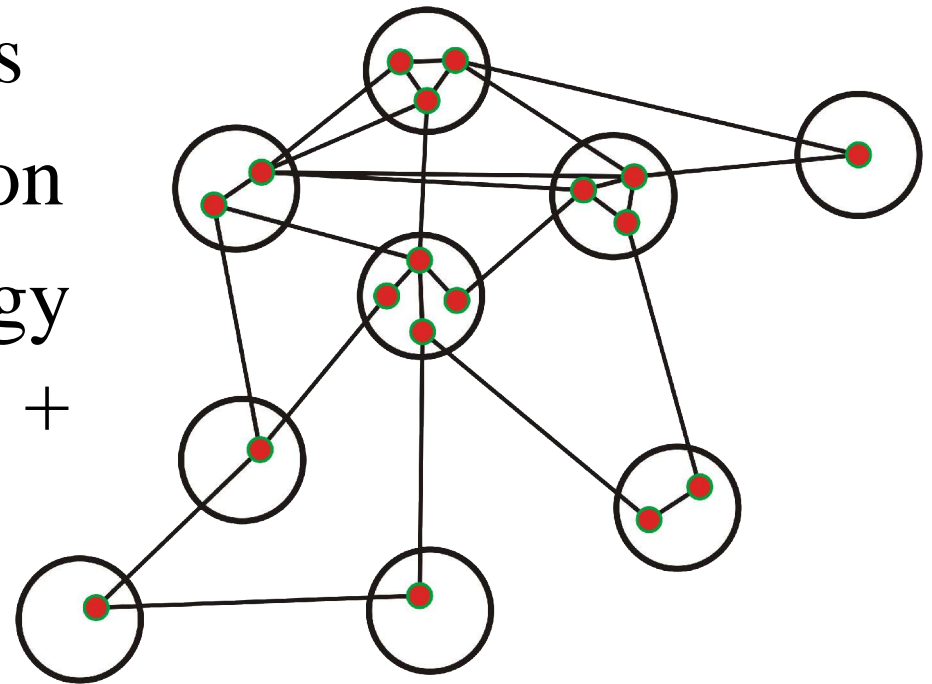
BGP Simulation Model : Topology Model

- “Classical” BGP Simulation Topologies
- Extracted from BGP *logs* (Route Views Project)
- Different Behaviour compared to real AS
- Logical AS
- Single linked neighbours
- Restrictions on Observed Behaviours



BGP Simulation Model : Topology Model

- Realistic topologies
- *BGP Sessions Topologies*
- Multiple linked neighbours
- Complex AS representation
- BGP Sessions Topology
Generation: AS Topology +
Router Level Information



BGP Simulation Model : Routing Policies and Message Delays

- Routing Policies:
 - Achieve transit service agreements between Ass
 - Implemented as *Decision Rules*
 - Neighbour AS Relationships: *customer-provider* and *peer-peer*
- Messages Delays:
 - Link crossing delay
 - CPU charge induced delay

Conclusion

- Proposed BGP Simulation Model
- BGP Sessions Topologies generation algorithm
- Completed work:
 - BGP Session Topologies Inference algorithm implementation
 - AS Topology hierarchy Deduction algorithm
- Next Steps:
 - Routing Policies generation from Topological data

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