Simulation-based performance assessment of QoS-enhanced BGP

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MESCAL qBGP SO1 Simulator

- ***We require:***
  - Ability to simulate large networks, 100+ nodes, maybe 1000’s
  - Accurate delivered QoS measurements, per demand, per pSLS.
  - Packet flow treatment models.
  - Model MESCAL network entities (AS, ASBR, MCs, pSLSes..)

- ***We don’t require:***
  - Every smallest detail of the BGP protocol, no i-BGP sessions, timeouts etc..
  - Packet level simulation.

Scenario creation

- Single SO1 meta-class
- Full mesh of demands
  - $N_{demands} = ½ N_{nodes}.(N_{nodes} – 1)$
  - Bandwidths uniformly randomly generated
- BRITE generated Power-Law networks: 100 nodes. $d_{ave} = 2$.
- Realistic pSLS capacities
  - Derived from demand matrix
    - Capacity is located in *useful* places.
    - *Near* shortest paths
  - Base capacities multiplied by over-provisioning co-efficient
- M/M/1 models for pSLS queuing delay

q-BGP policies under test

- **MetaClass ID ONLY**
  - Route selection based purely on AS_PATH length
  - Equivalent to typical BGP4 policy (although no LOCAL_PREF).

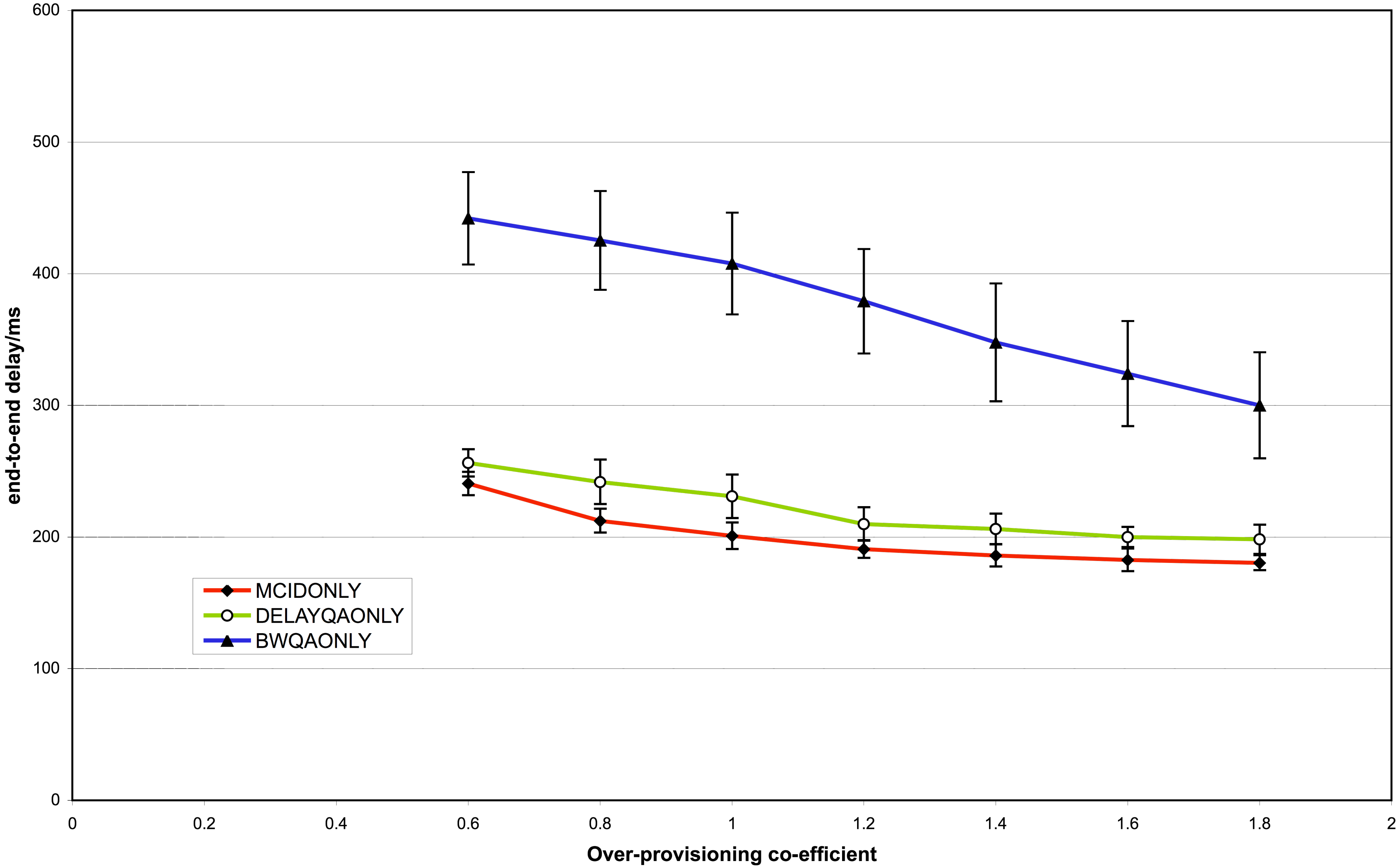
- **Delay QoS Attribute ONLY**
  - Route selection based on OWD QoS attribute.
  - Re-advertise

    Incoming_MSG_OWD_QA + Administratively_set_delay_value.

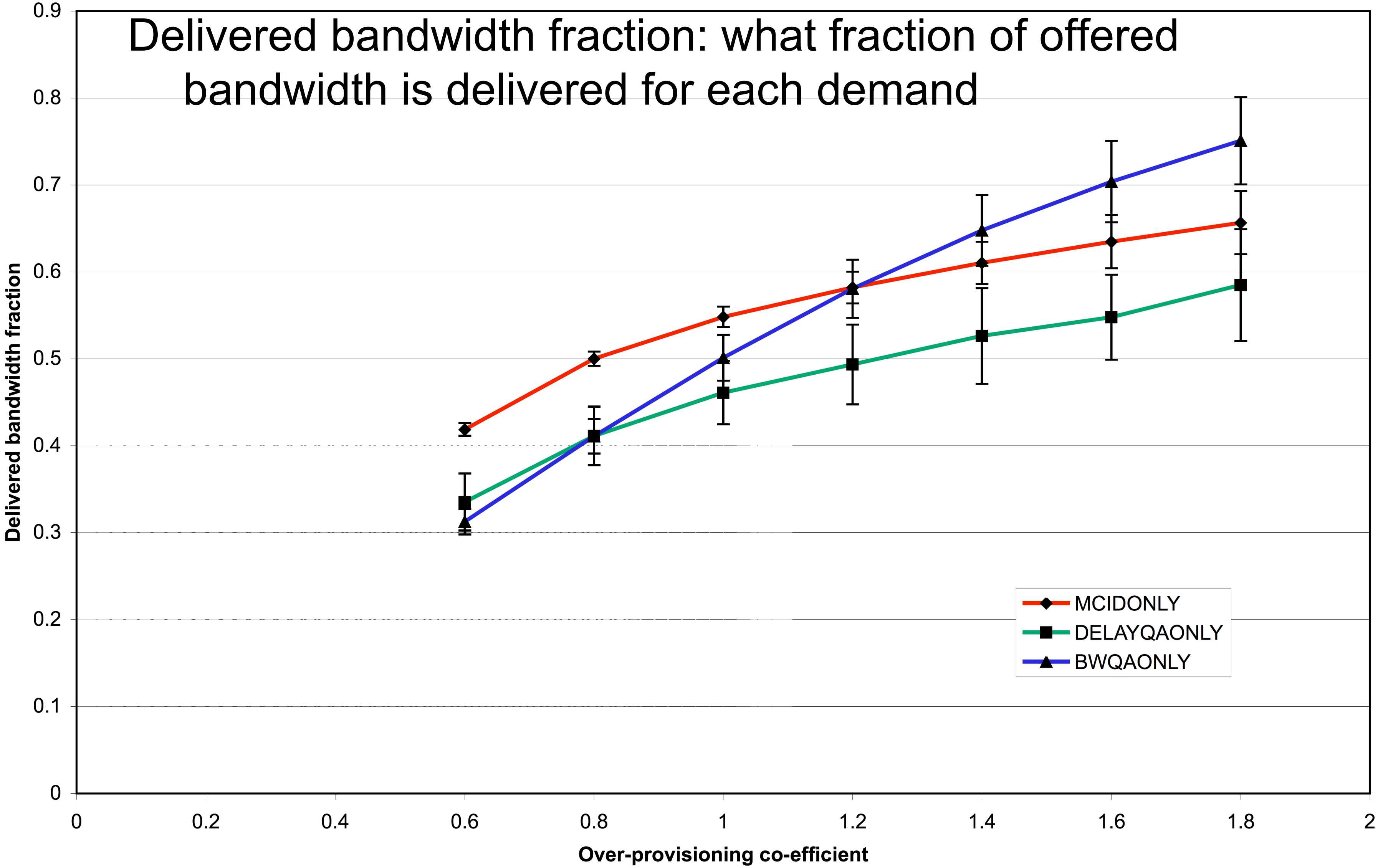
- **Bandwidth QoS Attribute ONLY**
  - Route selection based on Bandwidth QoS attribute.
  - Re-advertise

    min (Incoming_MSG_BW_QA, pSLS_CAPACITY)

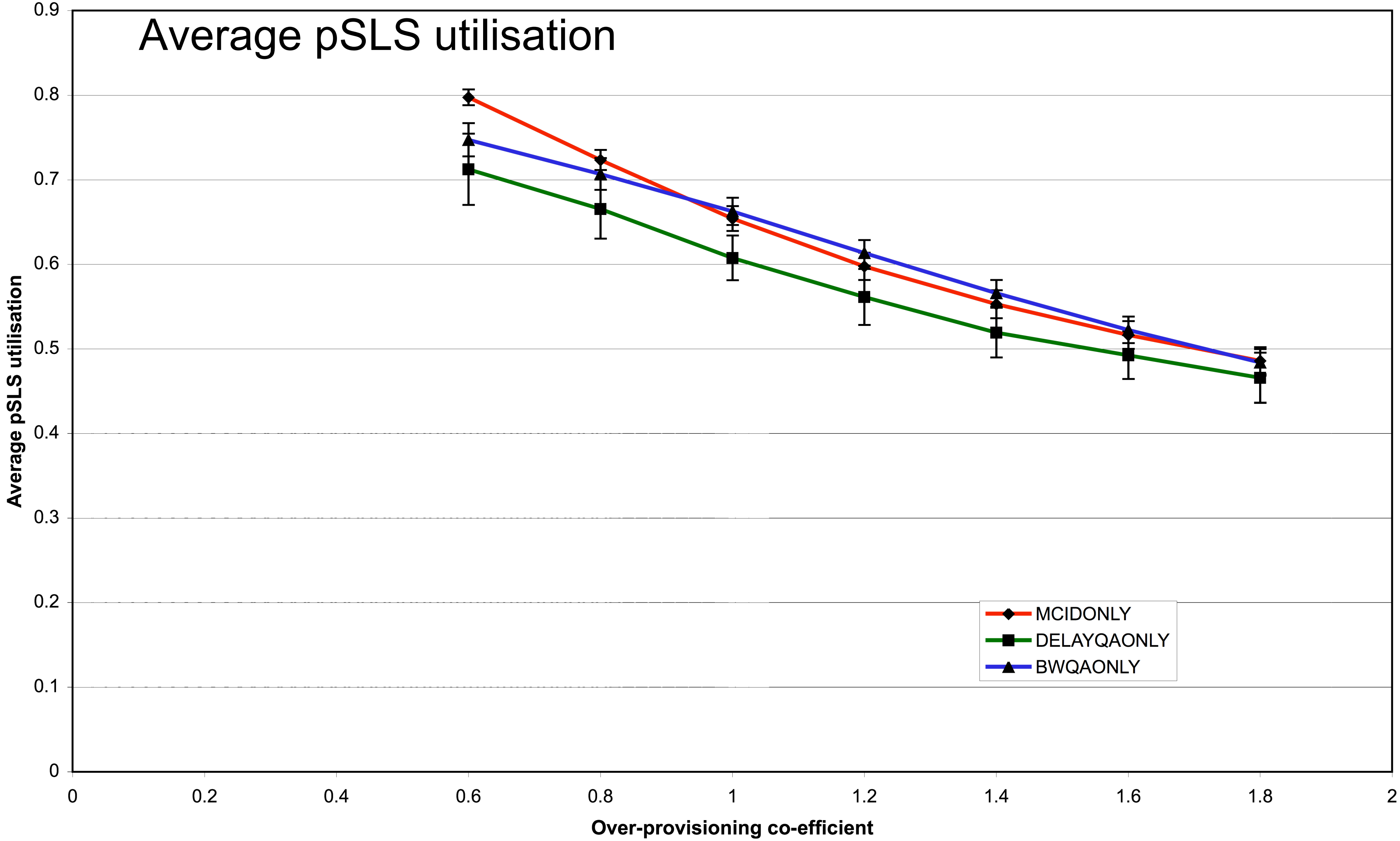
Efficacy: Delivered QoS - static QoS attributes



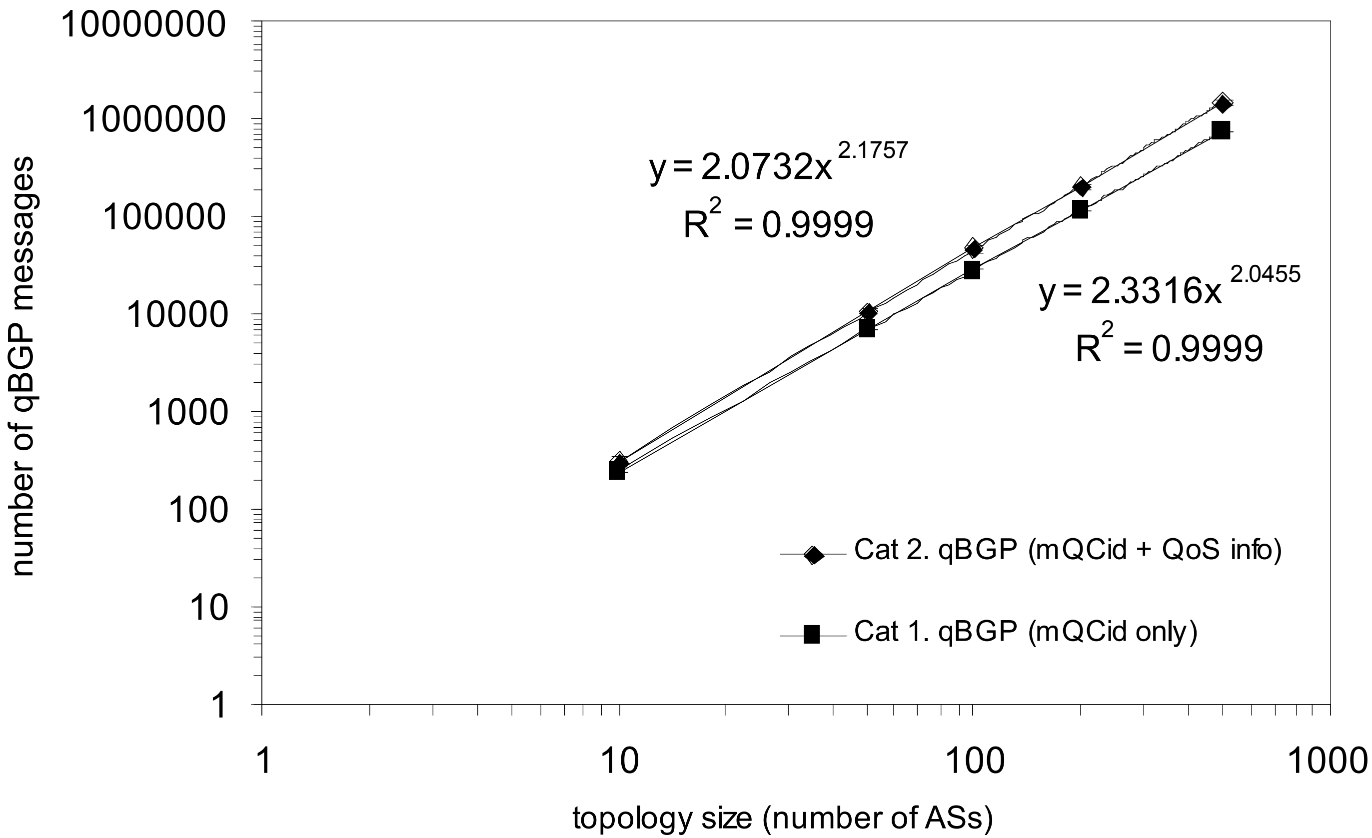
Q-BGP Efficacy: Delivered Bandwidth Fraction



Q-BGP Efficacy: Load distribution



Q-BGP scalability



Conclusions

- Advertising static QoS-info is detrimental to delivered QoS
  - the “QA rush”

- Number of qBGP messages scales similarly to existing shortest-path BGP (at least for static QAs).

Current and future work

- Administrative set QoS Attributes
  - Attribute calculation
- Multiple priority level route selection
- Monitoring Based QoS Attributes in messages
  - Stability issues – dampening, QA calculation
  - Re-advertisement policy
- Multiple meta-classes
  - with soft-partitioning?
- Aggregation
  - Realistic Network Prefix distribution in Simulator