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Over-provisioning Centric Network Resource Control in Future Internet Systems

S. Jardim[1], A. Neto[2,4], J. Castillo[2,3] , E. Cerqueira[5], F. Silva[6]

[1]Informatics Institute, Federal University of Goiás, Goiânia-GO, Brazil

[2]Teleinformatics Engineering, Federal University of Ceará, Fortaleza-CE, Brazil

[3]Computer Engineering, University of Coruña, Coruña, Spain

[4]Institute of Telecommunications, University of Aveiro, Aveiro, Portugal

[5]Computer Engineering, Federal University of Para (UFPA), Belém-PA, Brazil

[6]Federal University of Rio Grande do Norte (UFRN), Natal-RN, Brazil

Agenda

1. Introduction
2. Overview of Legacy MARA
3. MARA-MI Proposal
4. Performance Evaluation
5. Conclusion and Future Work

Introduction

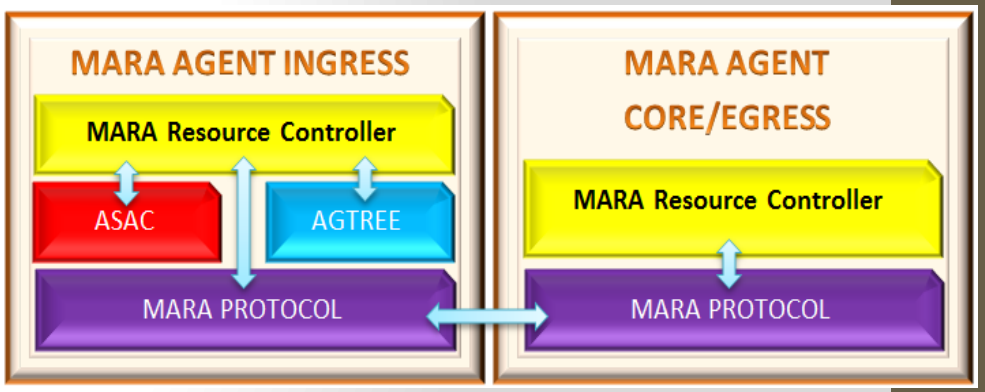
- The inability of current Internet to fulfill the rigorous Quality of Service (QoS) requirements of multimedia sessions, such as
  - audio/video conference, (web) IPTV, immersive video and video surveillance
- Research community define innovative mechanisms for the architecture of the Future Internet systems
  - Among others ultimate capabilities, support for multimedia multi-user sessions with QoS guaranteed over a period of time.
- Proposed to provide enhancing networking
  - Multi-user Aggregated Resource Allocation – MARA [1]
    - Dynamic control of per-class surplus bandwidth reservations (over-reservations) and aggregated IP multicast trees.

[1] Scalable Resource Provisioning for Multi-user Communications in Next Generation Networks, *Globecom) 2008*

MARA Overview

- Proposed as a potential tool to overcome the scalability limitations caused by per-flow QoS signaling solutions (including standards)

1. Adopts a signaling-constrained approach to assist the combined over-provisioning control of QoS (ASAC) and connectivity (AGTREE)
2. Its over-provisioning centric approach allows to stabilish multiple multi-user sessions without instant per session request signalling events
3. Enforces readjustments to demanding Class of Services (CoS) to provision bandwidth to assist the admission control
4. Reduces drastically the signalling and process overhead in comparison to previous solutions



Problem and Motivation

- Despite the benefits, Legacy MARA was architecturally deployed for systems hosting a unique ingress router
  - Current ISPs host multiple ingress routers in their systems, which drastically restrict Legacy MARA's deployment
  - Legacy MARA only take account of the current QoS capabilities of the bottleneck link for the selected data path
  - Multi-ingress hosting support certainly introduces correlations between on-path routers (perhaps more than one) and their associated ingress nodes
  - In order to avoid QoS violations, Legacy MARA's over-reservation needs awareness of the current QoS conditions of at least all the correlating on-path routers

Objective

- Re-architect the Legacy MARA to cope with the multi-ingress hosting capabilities of current and Future Internet systems
  - Design a decision point, aimed at enabling the selection of best aggregate multicast trees by path correlation awareness, to allow demanding multi-user sessions to be established efficiently

MARA-MI

- Hybrid approach with centralized and decentralized modules:

- New functionalities
  - Over-provisioning centric admission control shared into MARA-MI Agent Central and Ingress
  - Multi-ingress support:
    - System bootstrap
    - System announcement for synchronization
  - Multi-ingress aware readjustment of over reservations

MARA-MI Manager

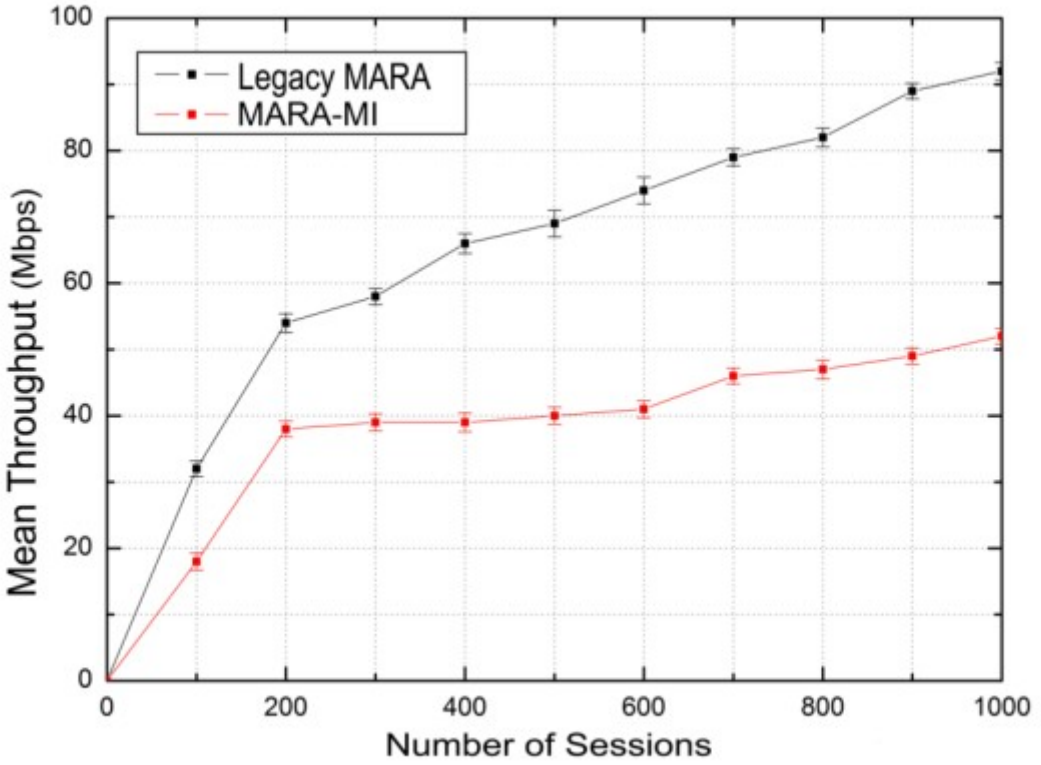
- Expose MARA-MI functionalities to external applications and mechanisms interested in establishing flows along the system
- System bootstrap
  - Triggered by ingress routers through announcements messages;
- Over-provisioning Centric Admission Control
  - Takes account correlation between paths;
    - Statefull approach, for both entire paths and links;
  - Path selection mechanism

    Aiming to reduce the need of signalling as much as possible

Performance Evaluation

- Carried on the Network Simulation v2 for convenience
- Methodology: compare Legacy MARA and MARA-MI with identical scenarios and configurations
- Configuration parameters are based on existing and our previous works
- Measures for benchmarking:
  - Networking cost estimation: signalling load over time (Throughput)
  - Quality perceived by users: Latency and Packet Loss over time

Results: Throughput

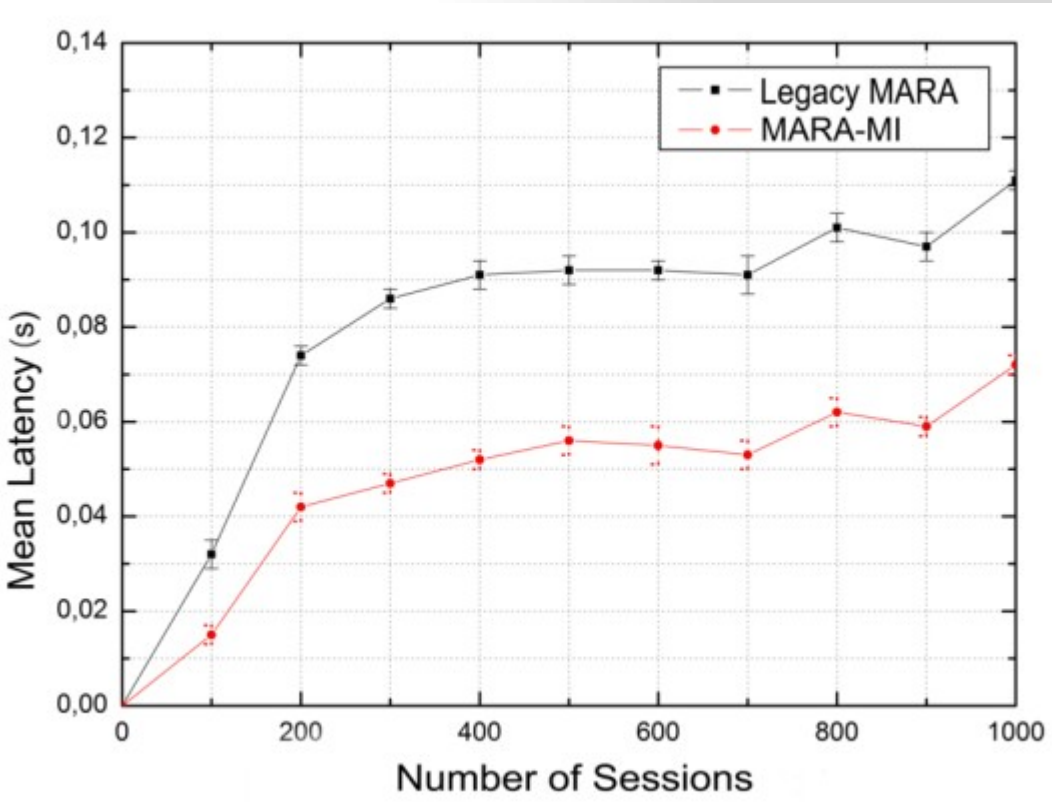


82% averaging optimization

Results: Latency

40.9% of improvement

MARA-MI Improvement reasons:
- Selected best paths
- Reduced signalling load
- Enables sessions faster

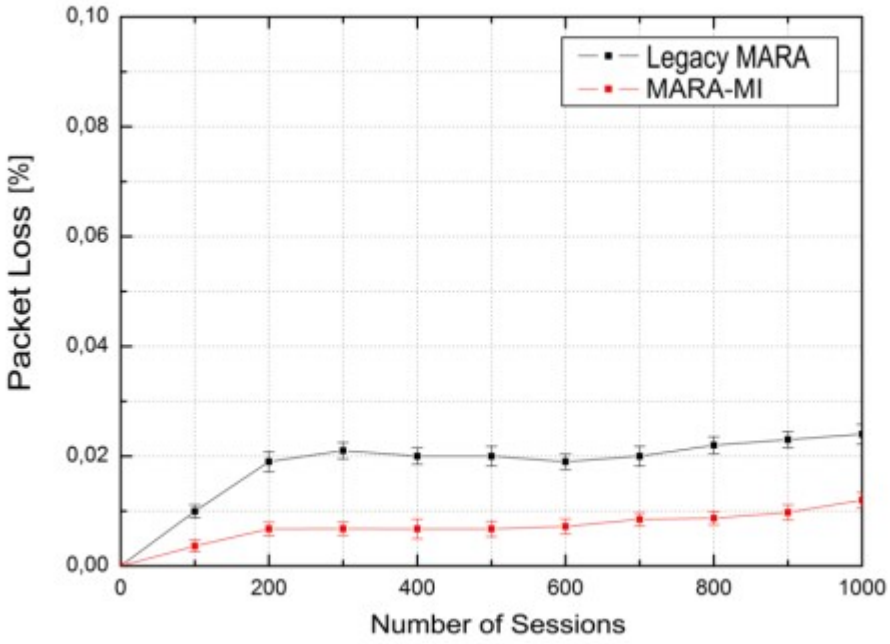


Results: Packet Loss

61.19% of improvement

MARA-MI Improvement reasons:

- **Path Selection Mechanism with path correlation awareness**
- **Incorrect parameters to path selection in Legacy MARA**



Conclusion

- The MARA-MI mechanism improves significantly the efficiency of Legacy MARA by reducing the signalling load and latency within the entire system.
- The new hybrid scheme allowed the use of MARA-MI in a multi-ingress router scenario efficiently.

Future work

- Try the new proposal in more complex scenarios.
- Compare with other overprovisioning mechanisms.
- Measure the behaviour of the MARA-MI in a real world scenario, not in simulations.