Simple Economic Management Approaches of Overlay Traffic in Heterogeneous Internet Topologies

ICT STREP SmoothIT, FP7, Call 1, ICT-1.1.1-Network of the Future

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Basics and Motivation

❑ Today, use of economic mechanisms for controlling, managing network traffic of overlays at early stages:

⟹ Economic Traffic Management (ETM)

❑ Initial results show that such mechanisms do have the important property of scalability!

– Lead to a more efficient network operation, for wireless access networks and wire-line backbones

– Generate higher value for its customers.

❑ In managing the traffic created and routed through their networks, today's ISPs employ methodologies suitable for conventional traffic/service profiles

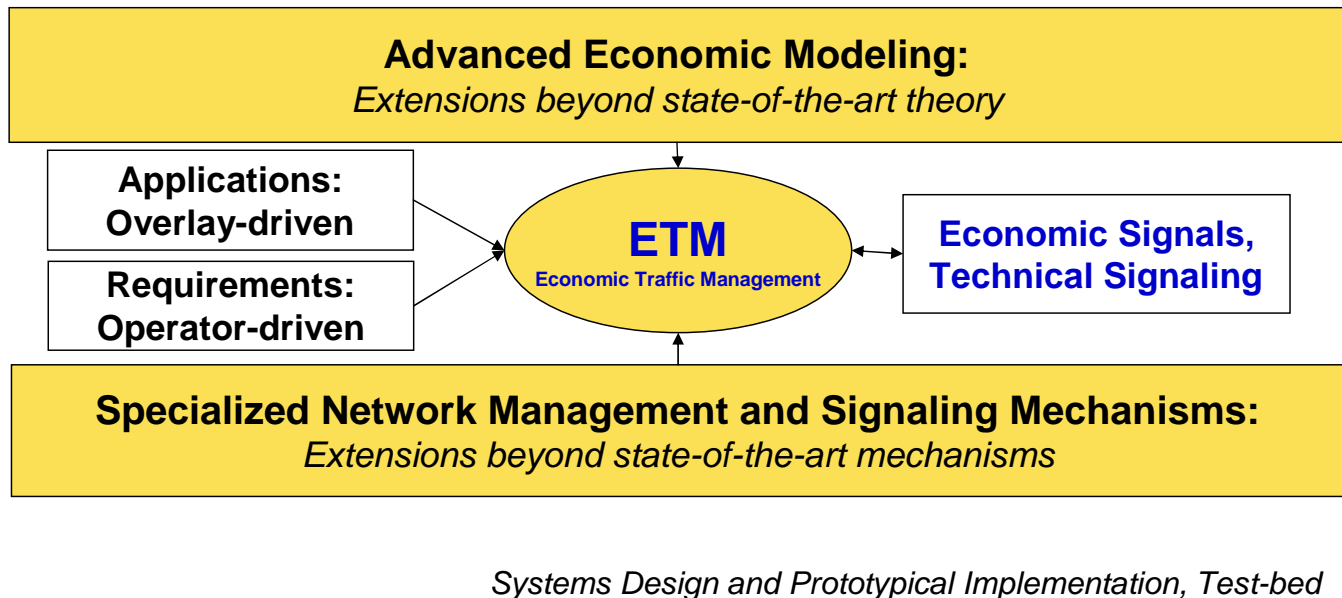– *E.g.*, peer-to-peer traffic is treated according to traditional techniques.

Methodology

Theory and Formal Analysis, Simulations

Advanced Economic Modeling:
Extensions beyond state-of-the-art theory

Applications: Overlay-driven	
Requirements: Operator-driven	

ETM
Economic Traffic Management

Economic Signals, Technical Signaling

Specialized Network Management and Signaling Mechanisms:
Extensions beyond state-of-the-art mechanisms

Systems Design and Prototypical Implementation, Test-bed

SmoothIT Objectives

- **Structure Internet-based overlay networks** to be efficient and optimal for **users, overlay providers**, and **ISPs (*win-win-win* situation)**
  - Investigate, design, and apply specialized **economic theory** for **decentralized network efficient Internet-based overlay services in multi-domain scenarios,** including wireless access
  - **Develop** an optimized **incentive-driven signaling approach** for defining (theory) and delivering (technology) economic signals in support of cooperating and competing providers

- **Operator-orientation:** demonstrating key results through a strong focus on **ISP and telecom requirements**
- **Implementation-orientation**: design, prototype, and validate the **networking infrastructure** (real-life test-bed)
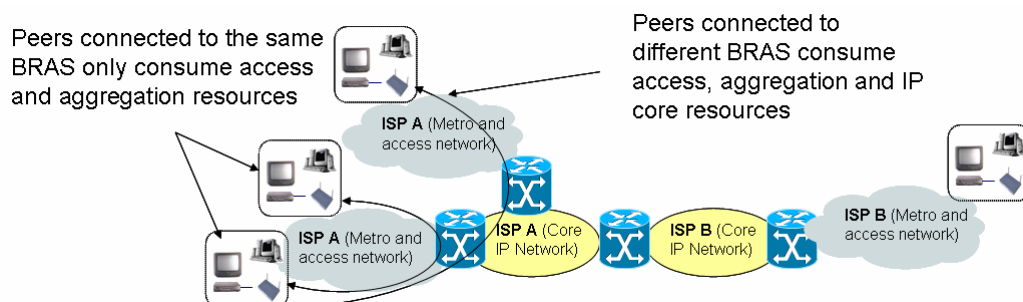
Win – Win – Win

❑ Management of **overlay networks** based on a collaboration between the overlay provider and the network (underlay) provider in support of the user
  – Cost and investment recovery for operators

❑ Incentives for operators
  – Reduce overlay traffic and inter-domain traffic
  – Keep overlay services (boost flat rate tariffs; keep customers)
  – Avoid to be on an overlay block list and "make money" with transport
    `http://www.azureuswiki.com/index.php/Bad_ISPs`

❑ Incentives for overlay providers
  – Active role in traffic management increases service quality
  – Increased user base due to better performing services

❑ Incentives for user
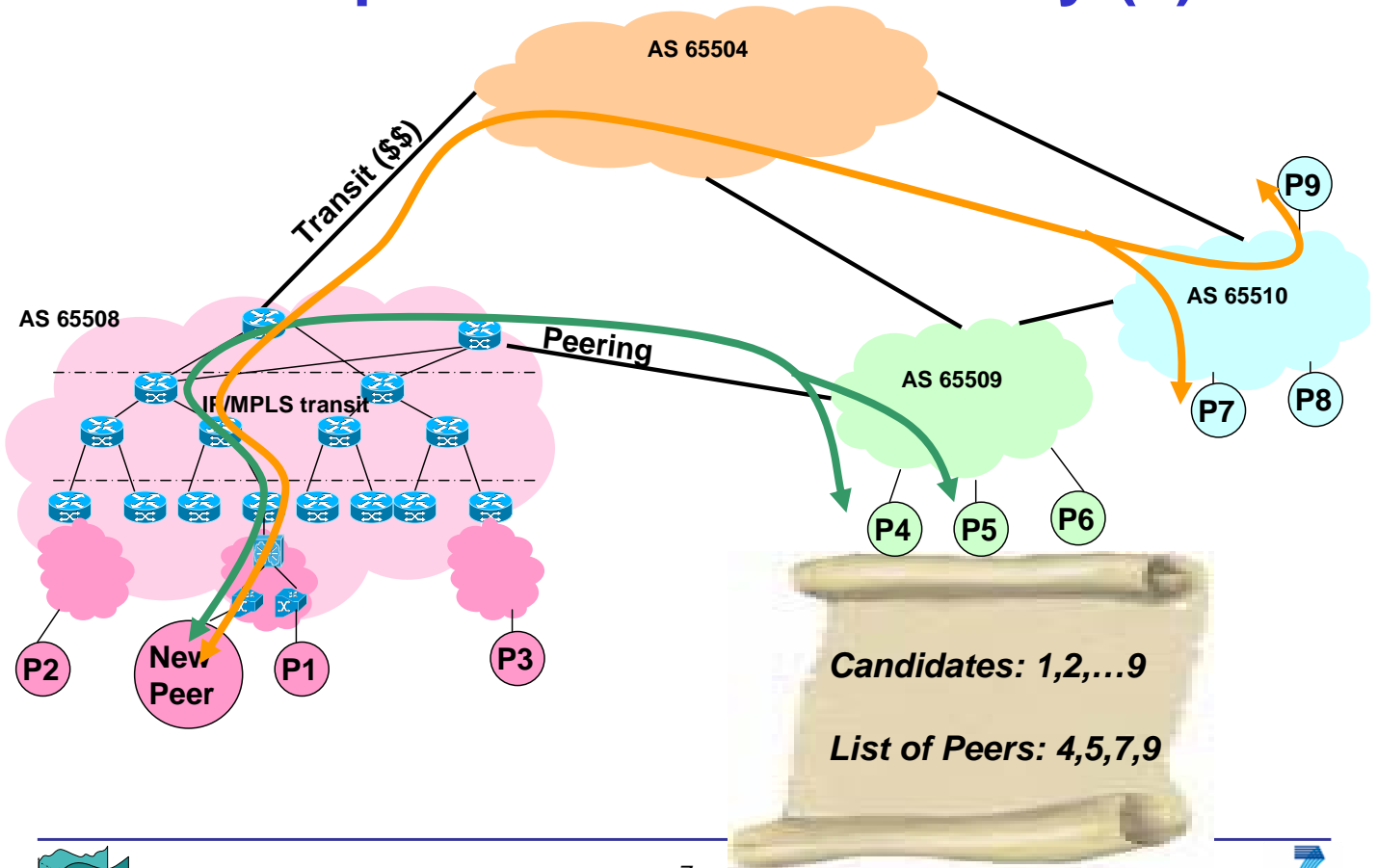 – Increased service quality, *e.g.*, in terms of reliability, RTT, bandwidth
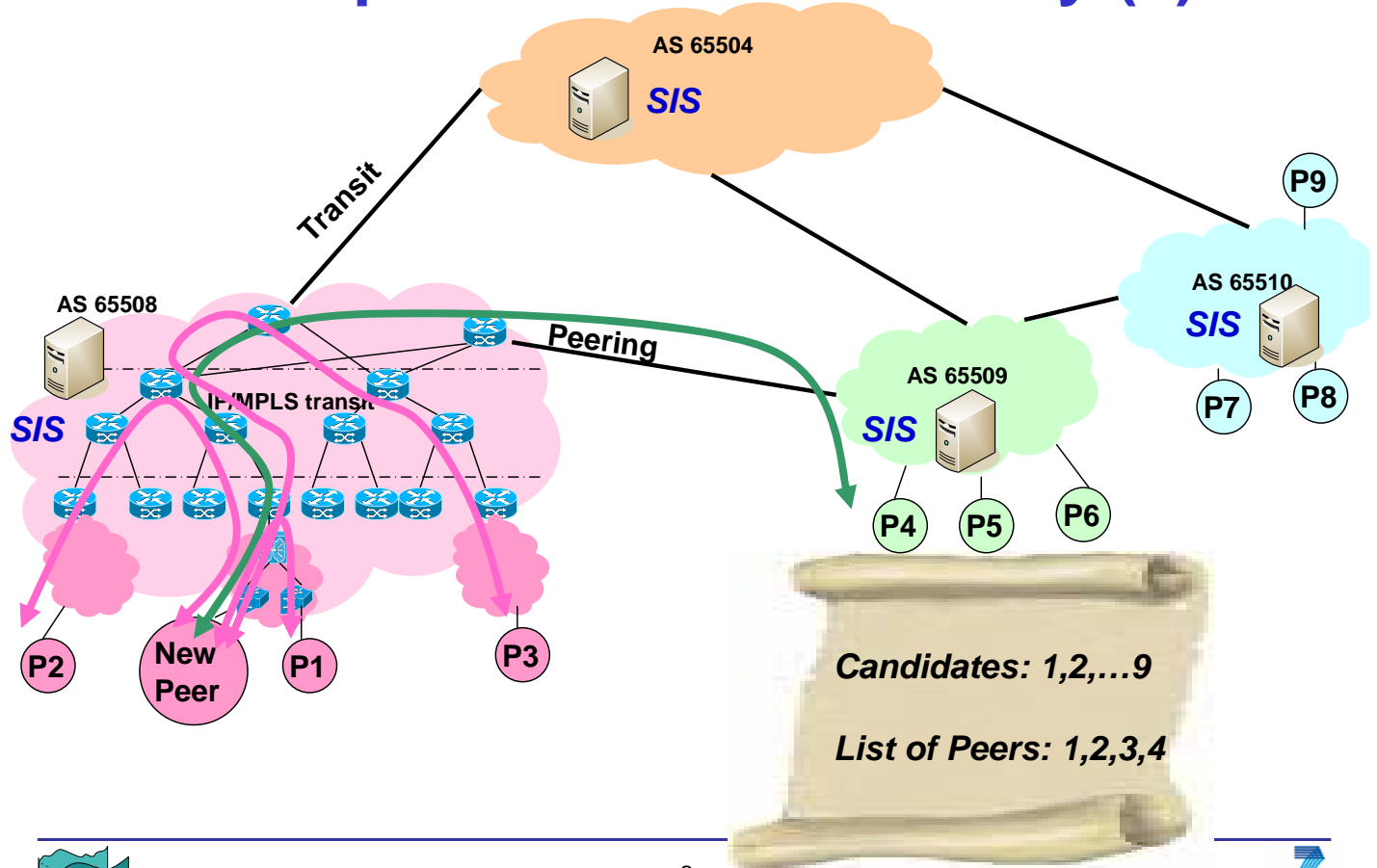

Solution Concepts

❑ Agreements between overlay provider and operator
  – *E.g.*, active caching:
    the operator provides explicit local caches for overlay content

❑ Locality promotion
  – Operator provides information about how to achieve best quality in overlay, *e.g.*, operator prioritizes alternative peer interconnections

❑ QoS/QoE differentiation (application-awareness)
  – Operator knows overlay application traffic (labels, deep packet inspection) and applies application-aware traffic manegement

Peers connected to the same BRAS only consume access and aggregation resources

Peers connected to different BRAS consume access, aggregation and IP core resources

ISP A (Metro and access network)

ISP A (Metro and access network)

ISP A (Core IP Network)

ISP B (Core IP Network)

ISP B (Metro and access network)

Example Scenario – Locality (1)

AS 65504

AS 65510

P9

Transit ($$)

Peering

AS 65508

IP/MPLS transit

AS 65509

P7

P8

P4

P5

P6

P2

New Peer

P1

P3

Candidates: 1,2,…9

List of Peers: 4,5,7,9

Example Scenario – Locality (2)

AS 65504

SIS

Transit

Peering

AS 65508

SIS

IP/MPLS transit

P9

AS 65510

SIS

AS 65509

SIS

P7

P8

P4

P5

P6

P2

New Peer

P1

P3

Candidates: 1,2,…9

List of Peers: 1,2,3,4

Challenges

❑ Integration and mapping of operator-driven and overlay service requirements into effective, manageable, and viable

economic and technical signals

within/in a multi-domain operational environment

❑ Development of an efficient and scalable economic management of all overlay types (mainly control and transport overlays) so that:

– They maximize the benefit for multiple operators/ISPs involved, independently of the underlying technology and topology

– They can be operated autonomously, show an increasing capability to withstand faults, and balance the load in the network.

Thank you for your attention!

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