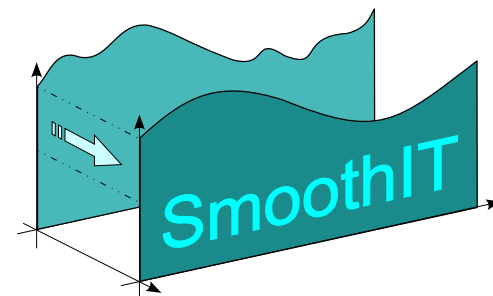


*Simple Economic Management Approaches of
Overlay Traffic in Heterogeneous Internet Topologies*

European Seventh Framework STREP FP7-2007-ICT-216259



SmoothIT Overlay Management Architecture

UZH, DoCoMo, TUD, AUEB, PrimeTel, AGH, ICOM, UniWue, TID

Peter Racz, UZH

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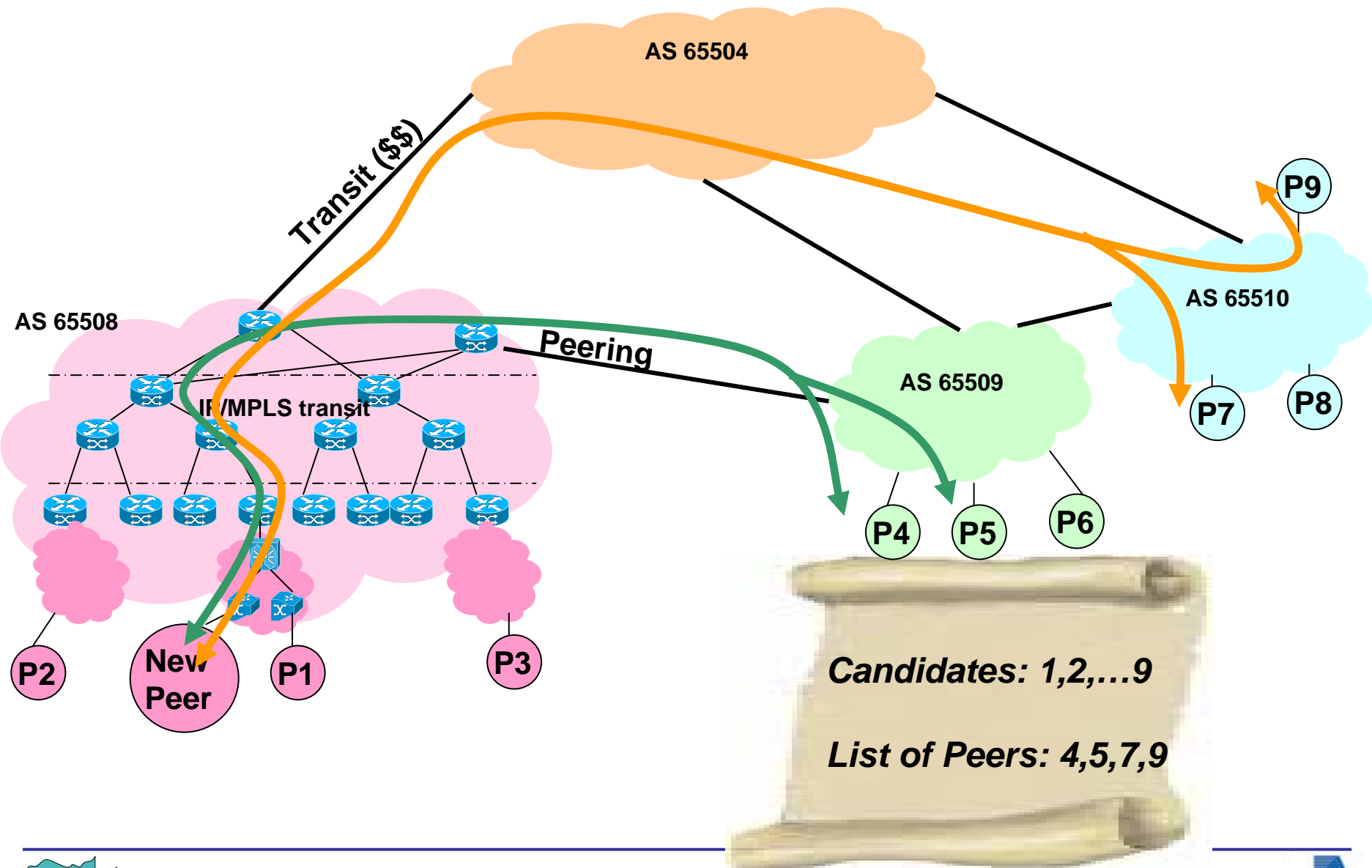
Outline

- ❑ Motivation and Example Scenario
- ❑ SmoothIT Objectives
- ❑ Incentives to Participate in ETM
- ❑ Solution Concepts
- ❑ Key Requirements
- ❑ SmoothIT Information Service
 - Architecture
 - Protocol
- ❑ Summary

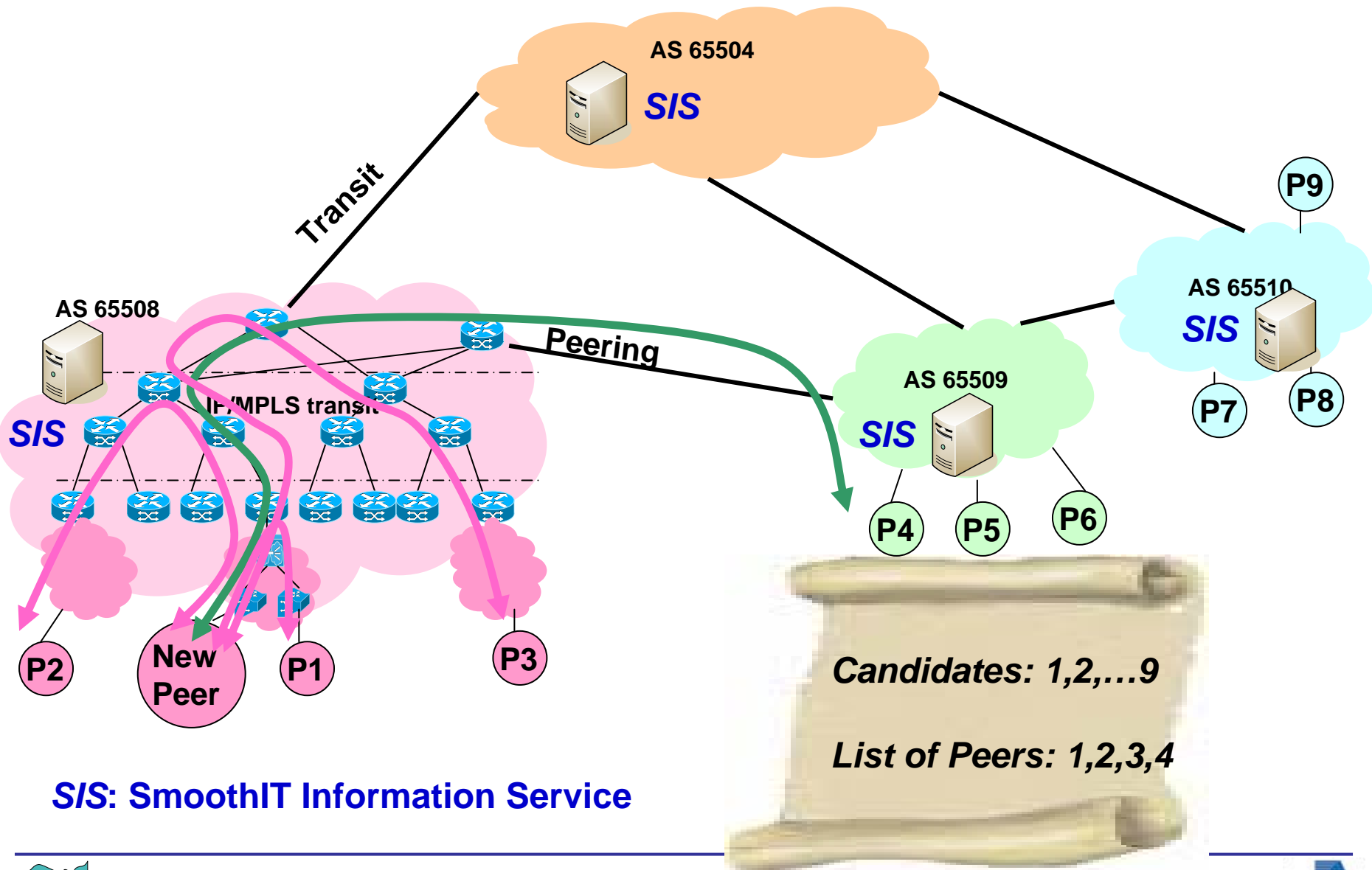
Motivation

- ❑ P2P applications and traffic
 - Significant and increasing amount of P2P traffic
 - Suboptimal peer selection due to information asymmetry
 - Underlay topology, incl. routing metrics and values, unknown to overlay
 - Overlay requirements, incl. traffic characteristics, unknown to underlay
- ❑ Consequence
 - Non-optimized overlay traffic in the underlay
 - Higher costs in underlay
 - Lower QoS in overlay
 - Conventional traffic management techniques not suitable
- ❑ Goal of the SmoothIT project
 - Bridge overlay with underlay
 - Apply Economic Traffic Management (ETM)
 - Optimize traffic and achieve win-win situation for all parties

Example: Locality-unaware Overlay



Example: Locality-aware Overlay



S/S: SmoothIT Information Service

SmoothIT Objectives

- ❑ **Structure Internet-based overlay networks** to be efficient and optimal for **users, overlay providers, and ISPs** leading to the “**win-win-win**” (*triple 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** (e.g., NN)

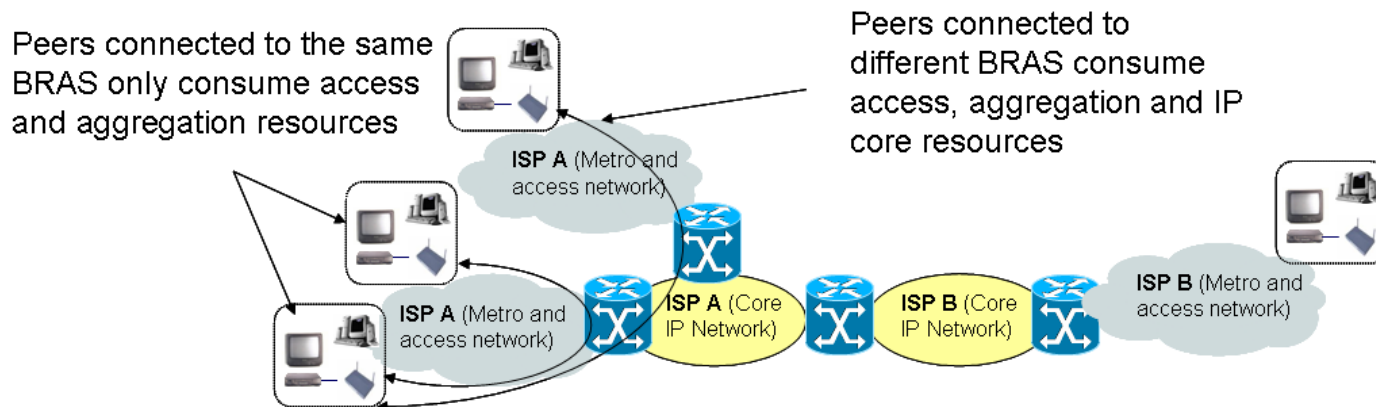
- ❑ **Implementation-orientation:** design, prototype, and validate the **networking infrastructure** (real-life test-bed)

Triple Win in Detail

- ❑ Management of **overlay networks** based on a collaboration between the overlay provider and the network (underlay) provider in support of the user (information is the key)
 - Cost and investment recovery for operators
- ❑ Incentives for **operators**
 - Reduce overlay traffic and inter-domain traffic, reduce costs
 - 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

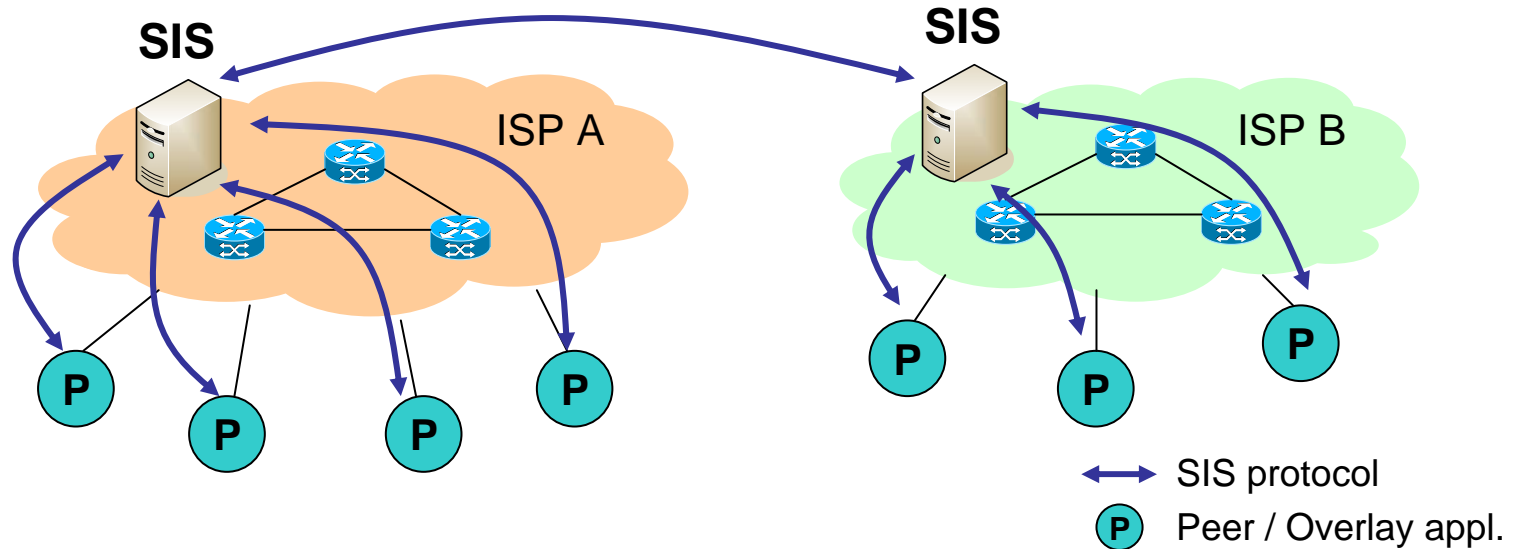
- ❑ **Agreements** between overlay provider and operator
 - *E.g.*, active caching:
the operator provides explicit local caches for overlay content
- ❑ **Locality promotion**
 - Operator provides information about how to achieve best quality in overlay, *e.g.*, operator prioritizes alternative peer interconnections
- ❑ **QoS/QoE differentiation** (application-awareness)
 - Operator knows overlay application traffic (labels, deep packet inspection) and applies application-aware traffic management



Key Requirements

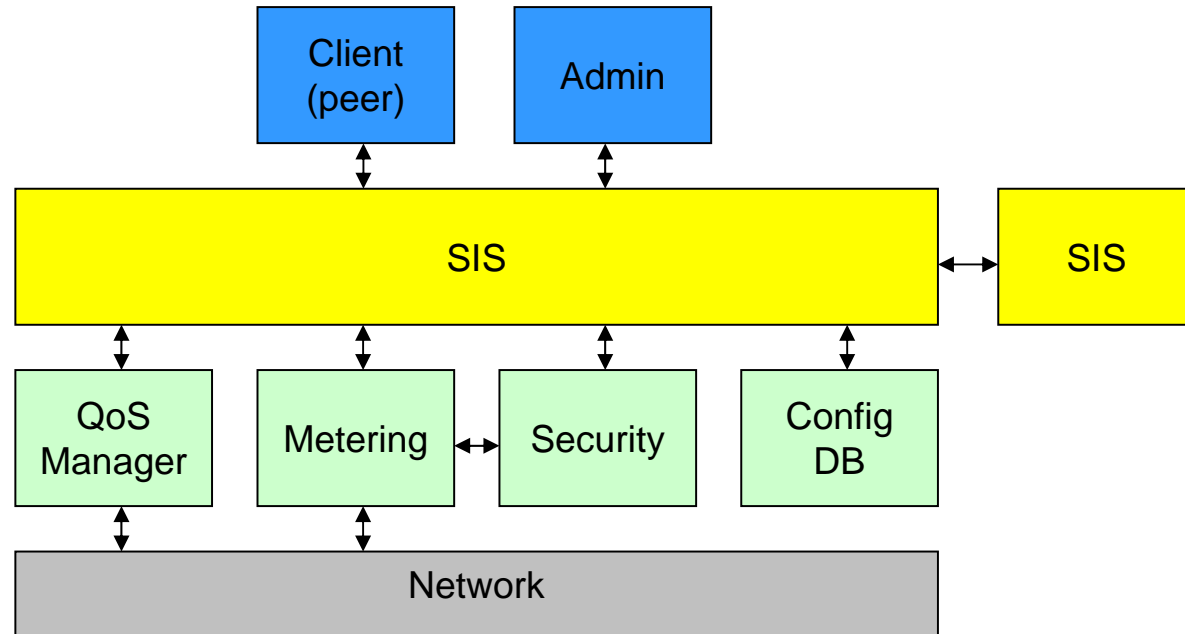
- ❑ Incentive-compatibility and traffic optimization
 - Provide incentives for all parties to achieve triple win
- ❑ Support of different overlay applications over a common interface
- ❑ Interface supporting various optimization schemes
 - E.g., different kinds of applications, high throughput, low delay, free/premium service
- ❑ Inter-domain support
- ❑ QoS support for network services
- ❑ Mobile network support
 - Node mobility, shared medium, heterogeneity of node and link capacities
- ❑ Easy deployment
 - In overlay applications and in ISPs' networks
- ❑ Extensibility
 - New applications, new metrics
- ❑ Scalability, efficiency, and robustness
- ❑ Security
- ❑ Standard compliance

SmoothIT Information Service (SIS)



- ❑ Deployment of SIS components in the ISPs' network
 - To convey information between overlay and underlay
- ❑ Client-Server architecture
- ❑ Overlay applications interact with SIS in order to select „better“ peers
 - Reducing costs of ISPs
 - Improving QoE of users

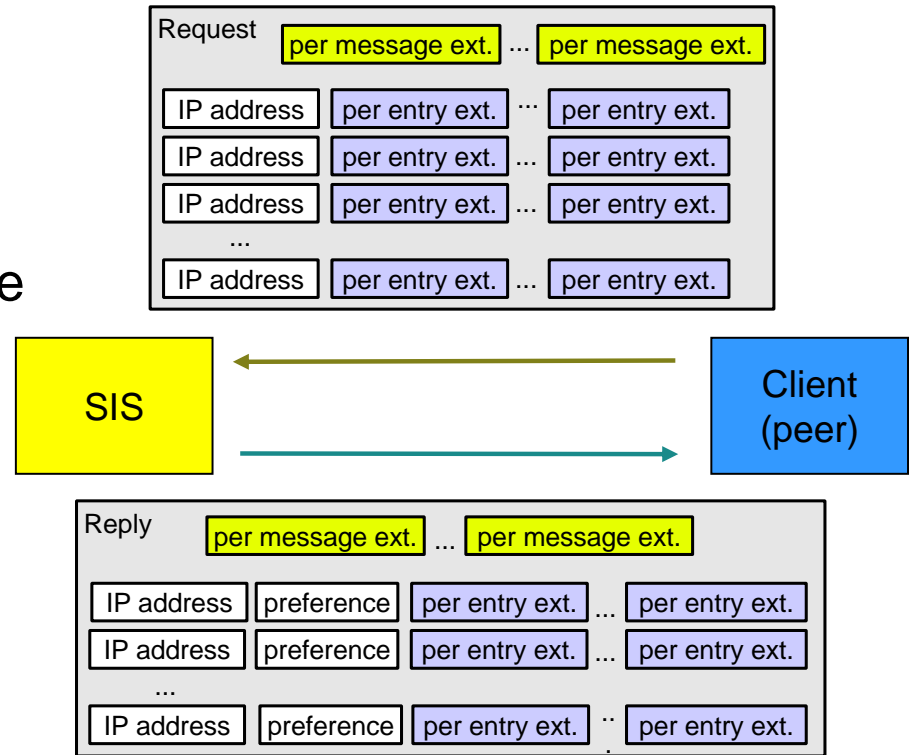
SIS Architecture



- ❑ SIS
 - Contains ETM logic
 - Aggregates information and calculates preference values
- ❑ Metering
 - Collects information from the network, e.g., BGP routing, topology
- ❑ QoS Manager
 - Performs QoS provisioning
 - Support of QoE schemes
- ❑ Security
 - Authentication and authorization
- ❑ Config DB
 - Stores various information about the network, e.g., topology, capacity

SIS Protocol

- Between SIS and overlay appl.
- Stateless request-response interaction scheme
- Application-independent
- Basic **preference information** service
 - Request: list of identifiers/peers (IP addresses)
 - Reply: list with preference values
- Optional **further parameters**
 - Per message or per parameter e.g., application type, desired QoS, capacity, locality, pricing information, peer availability



Possible Implementation

□ Protocol selection criteria

- Platform independence
- Language independence
- Standard compliance
- Maturity and stability
- Availability of parser libraries in different languages
- Simplicity, ease of use for overlay applications
- Efficiency, low protocol overhead
- Human-readability
- Formal and verifiable definition of message format

□ Candidates

- Web Service (SOAP + XML)
- REST
- JSON
- YAML
- Google protocol buffers
- HTTP-based custom protocol

Summary

- Management of overlay traffic is necessary
 - Large amount of traffic
 - High costs for ISPs

- SmoothIT Information Service
 - Deployed in the network of ISPs
 - Provide information to overlay applications
 - Optimize traffic and achieve win-win situation

Thank you for your attention!

Thanks to SmoothIT's project partners:

UZH, DOCOMO, TUD, AUEB, PrimeTel, AGH, ICOM, UniWue, TID



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DOCOMO Euro-Labs



University of Zurich
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