TEQUILA
Traffic Engineering QUality of service in the Internet at LArge scale

www.ist-tequila.org

Danny Goderis
Alcatel

Tequila Consortium

- Industrial Partners
  - Alcatel, Belgium
  - Algosystems S.A., Greece
  - France Telecom-R&D, France
  - Global Crossing, UK
- Universities
  - NTUA - National Technical University Athens, Greece
  - UCL - University College London, UK
  - UniS - The University of Surrey, UK
- Research Institutes
  - IMEC, Belgium
  - TERENA, Netherlands

TEQUILA Presentations

- The TEQUILA rationale for QoS delivery
  - D. Goderis (Alcatel)
- Traffic engineering the multi-service Internet
  - G. Pavlou (UniS)
- QoS-aware monitoring and measurement
  - R. Egan (Global Crossing)
- QoS routing over the Internet: a BGP-based approach
  - C. Jacquenet (France Telecom)

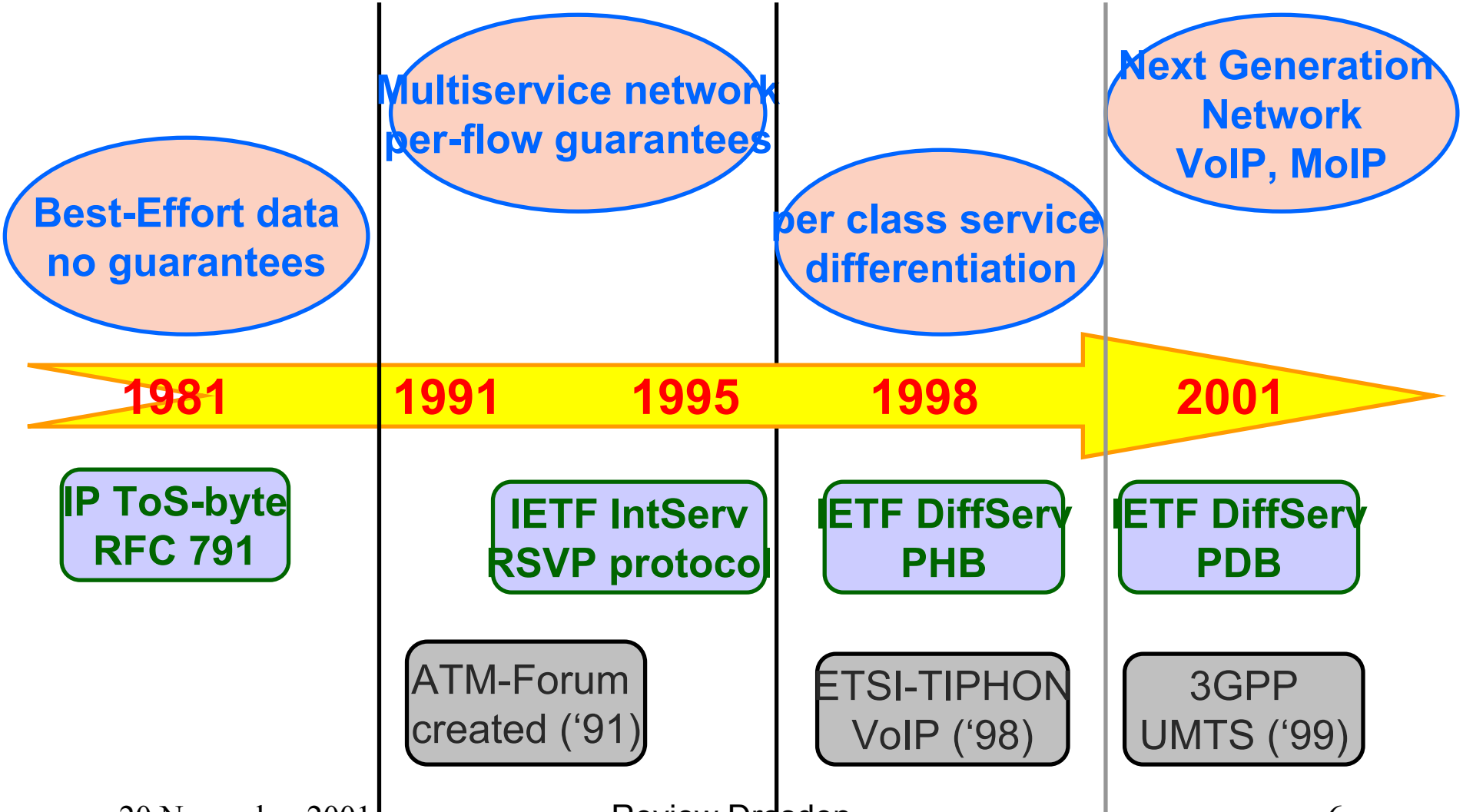
The TEQUILA rationale for QoS delivery

Danny Goderis
Alcatel

Outline

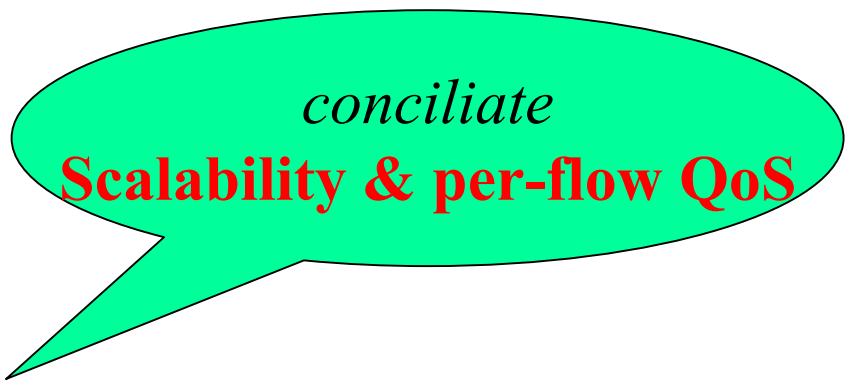
- Introduction
- A DiffServ layered service model
- Service provisioning & admission control
- The TEQUILA model illustrated

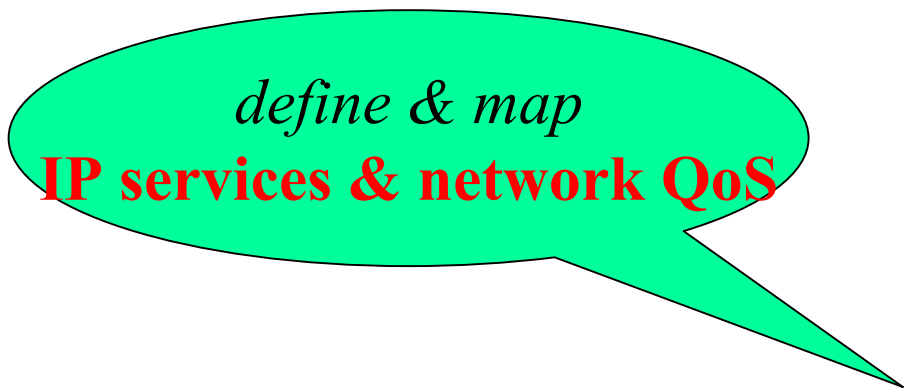
The IETF IP QoS Debate...



… and the IETF IP QoS Key Issues

- IntServ: scalability problem due to per-flow processing & admission
- DiffServ tackles scalability by per-class processing
  - But only *Edge-to-Edge* guarantees for *aggregate* packet streams...
    - no hard *per-flow* guarantees
  - ...and missing standards
    - Traffic Contracts - Service Level Specifications *TEQUILA proposal*



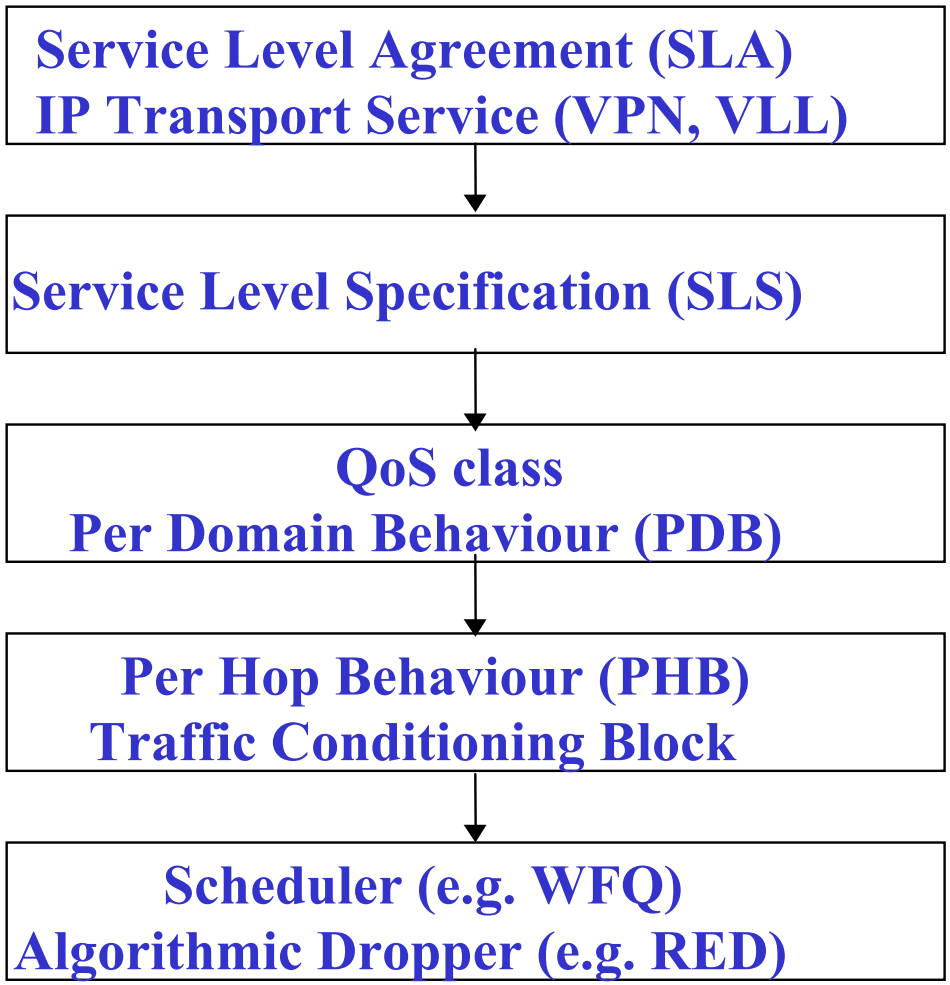


TEQUILA Key Concepts

	PSTN	*TEQUILA*
Technology	Circuit-switching	IP DiffServ
Granularity	64 kbps	DSCP, PHB
Service	Voice call	Service Level Specifications
Dimensioning	Erlang-B	Resource Provisioning Cycle
Allocation	CAC	2-level Admission Control

Part 2
A DiffServ Layered Service Model

From SLA to Packets



- Non-technical terms & conditions
- technical parameters :{SLS}-set

- IP service traffic characteristics
- offered network QoS guarantees

- Network QoS capabilities
- DiffServ edge-to-edge aggregates

- Generic Router QoS capabilities
- DiffServ core & edge routers

- vendor & product specific implementation

TEQUILA SLSs

Parameter Group	Description
Customer-user Id	Identifies the *customer*
Flow descriptor	*Packet stream* (DSCP, IP addresses, etc)
Service Scope	*Geographical region* (ingress–egress)
Service Schedule	Specifies *when* the contract is applicable
Traffic descriptor	*Traffic envelop* (e.g. a token bucket)
QoS Parameters	*QoS guarantees* (delay, jitter, packet loss)
Excess Treatment	*Traffic conditioning* (dropping, remarking)

Tequila QoS Classes ~ PDBs

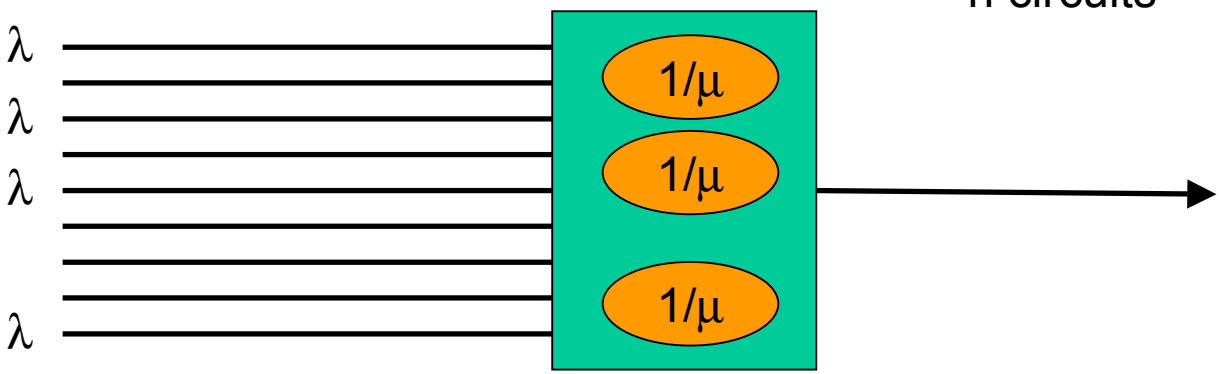
- QoS class = [OA | delay | loss]
  - Ordered Aggregate ~ PHB scheduling class
    - EF, AFx, BE
  - delay
    - edge-to-edge maximum delay
    - worst case or probabilistic (percentile)
    - delay classes (min-max intervals)
  - loss
    - edge-to-edge packet loss
    - probability

Part 3
Service Provisioning & Admission Control

PSTN Dimensioning

N subscribers
BHCA = λ, MCD = 1/μ

Central Office
n circuits

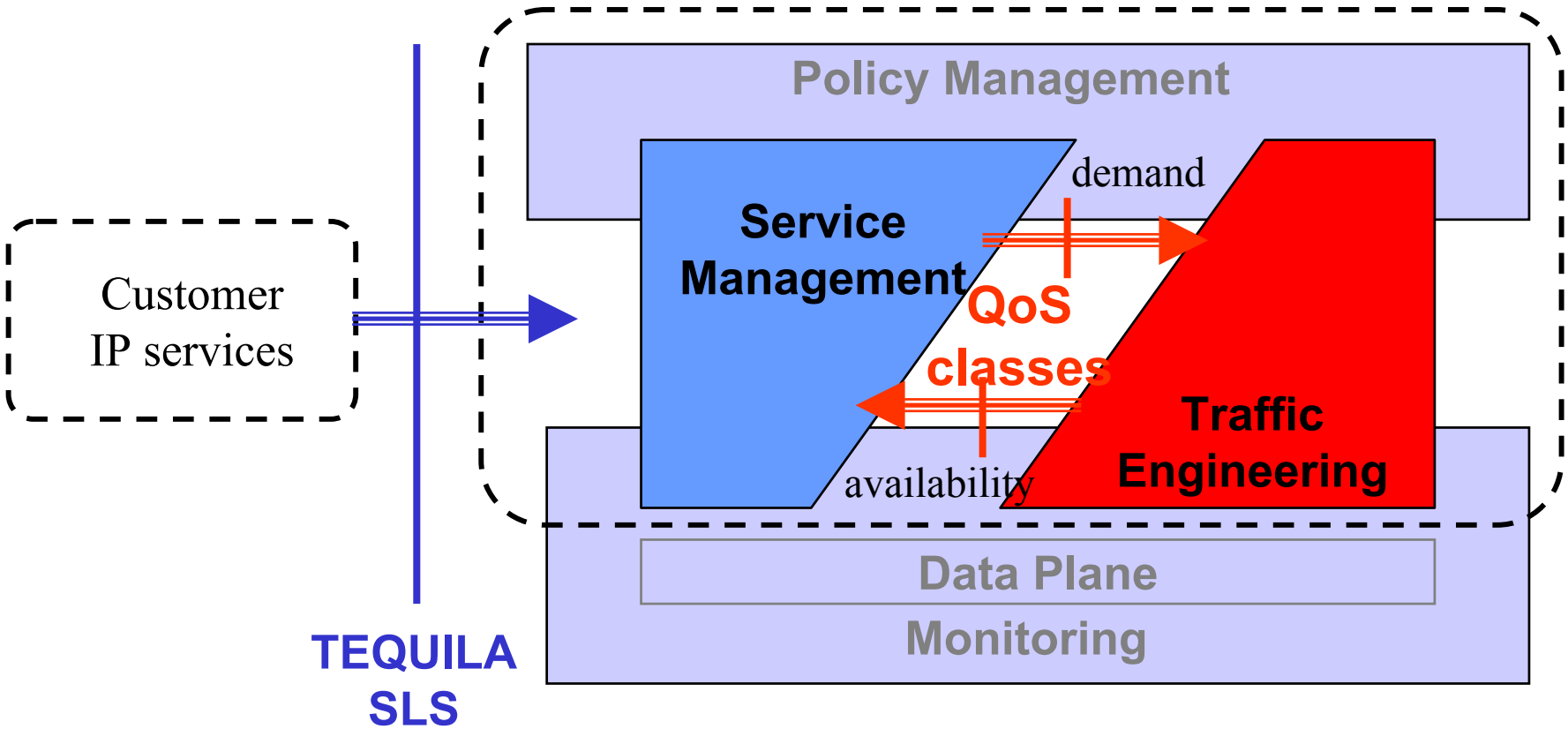


Erlang B

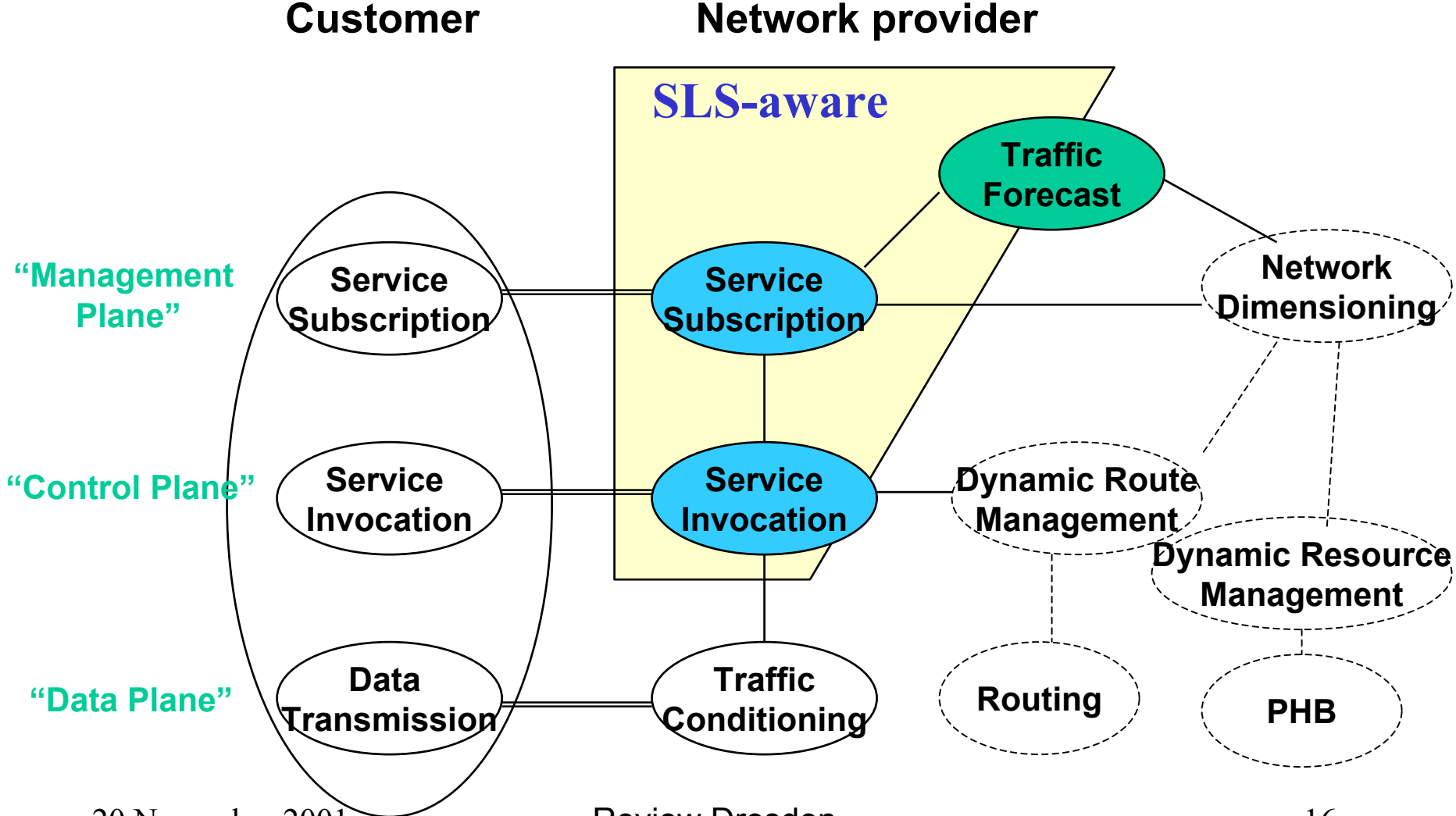
$$\text{Call blocking probability} = \frac{\frac{\rho^n}{n!}}{\sum_{i=0}^{n} \frac{\rho^i}{i!}} \leq \varepsilon$$

$\rho = N\lambda/\mu$

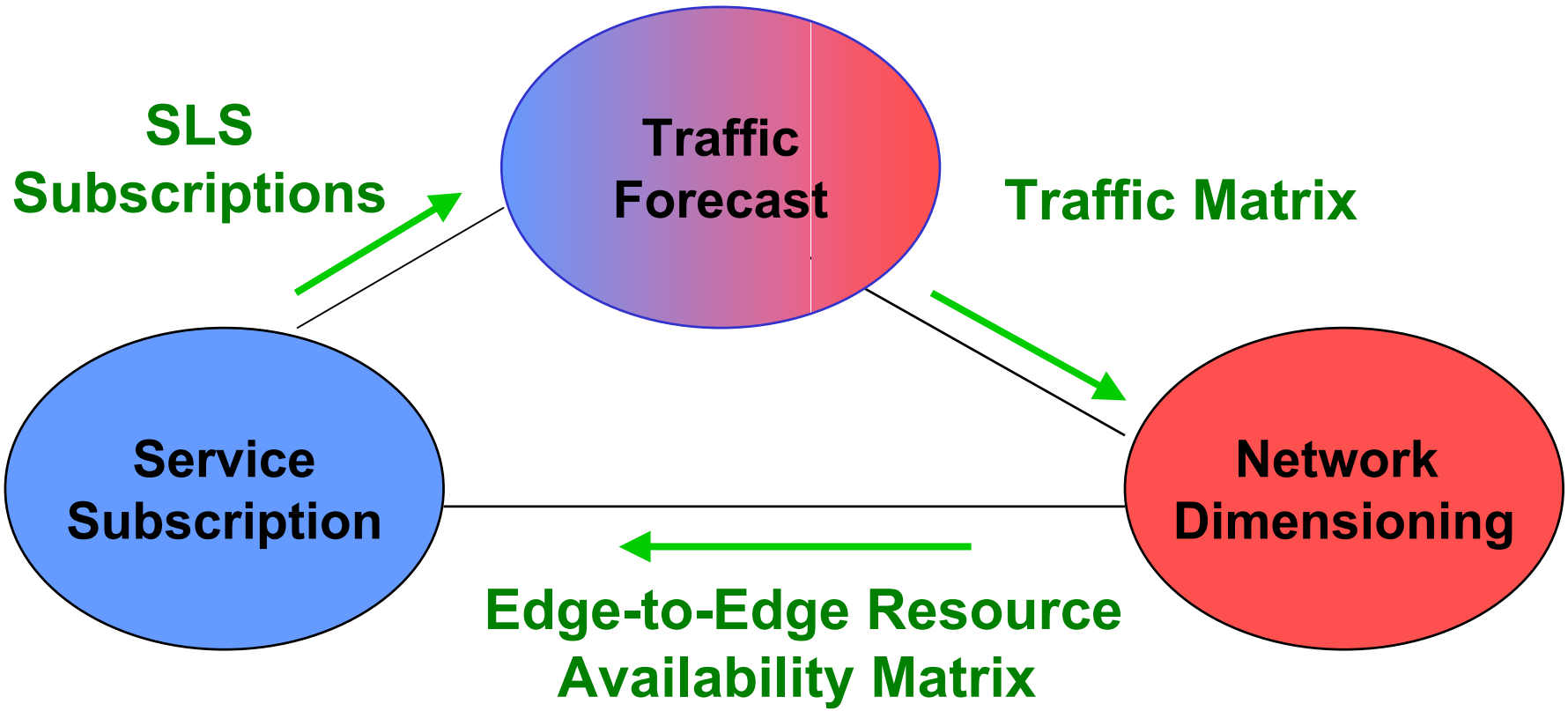
Tequila Approach for IP QoS Delivery



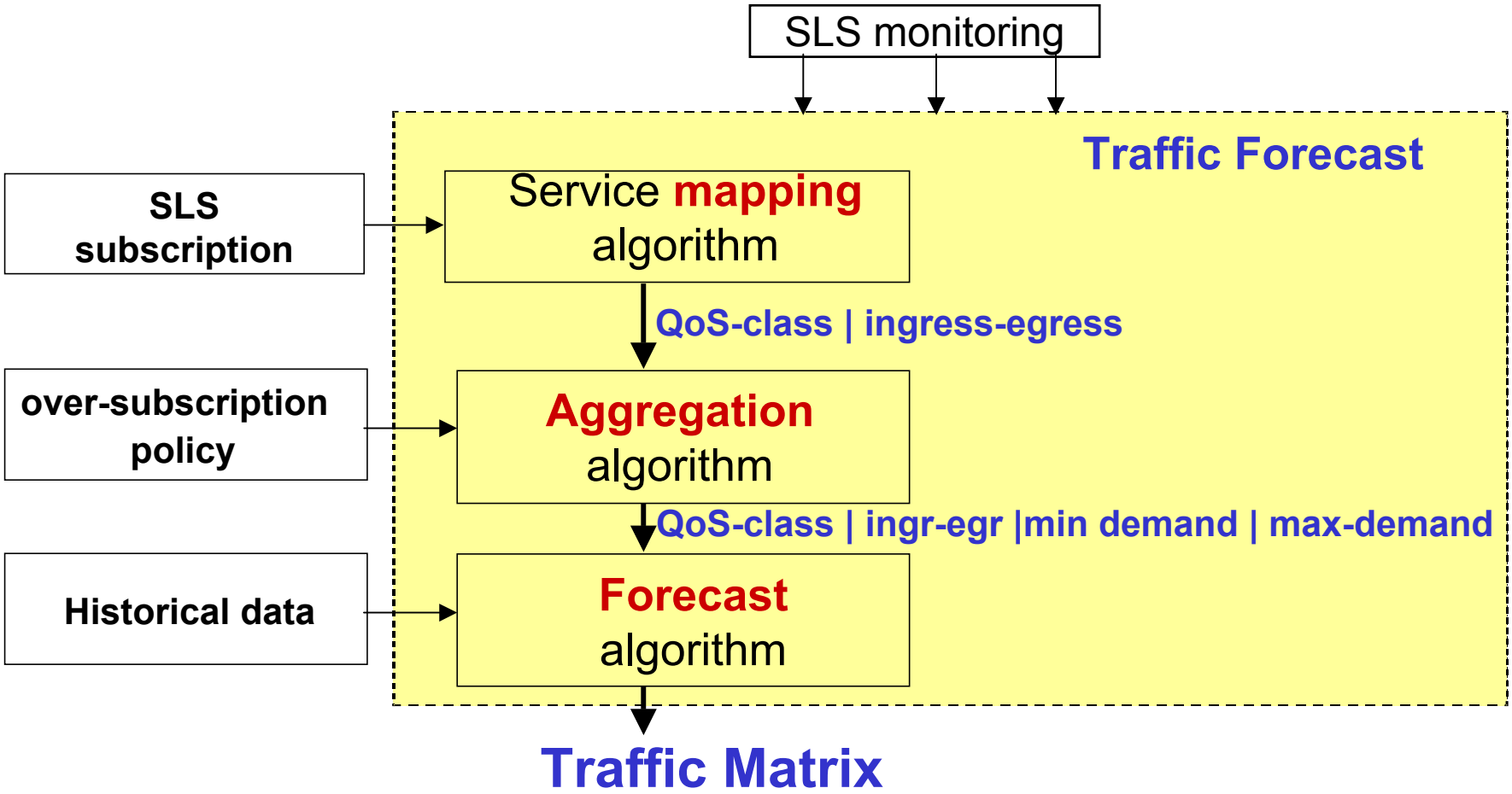
Service Management



Resource Provisioning Cycle

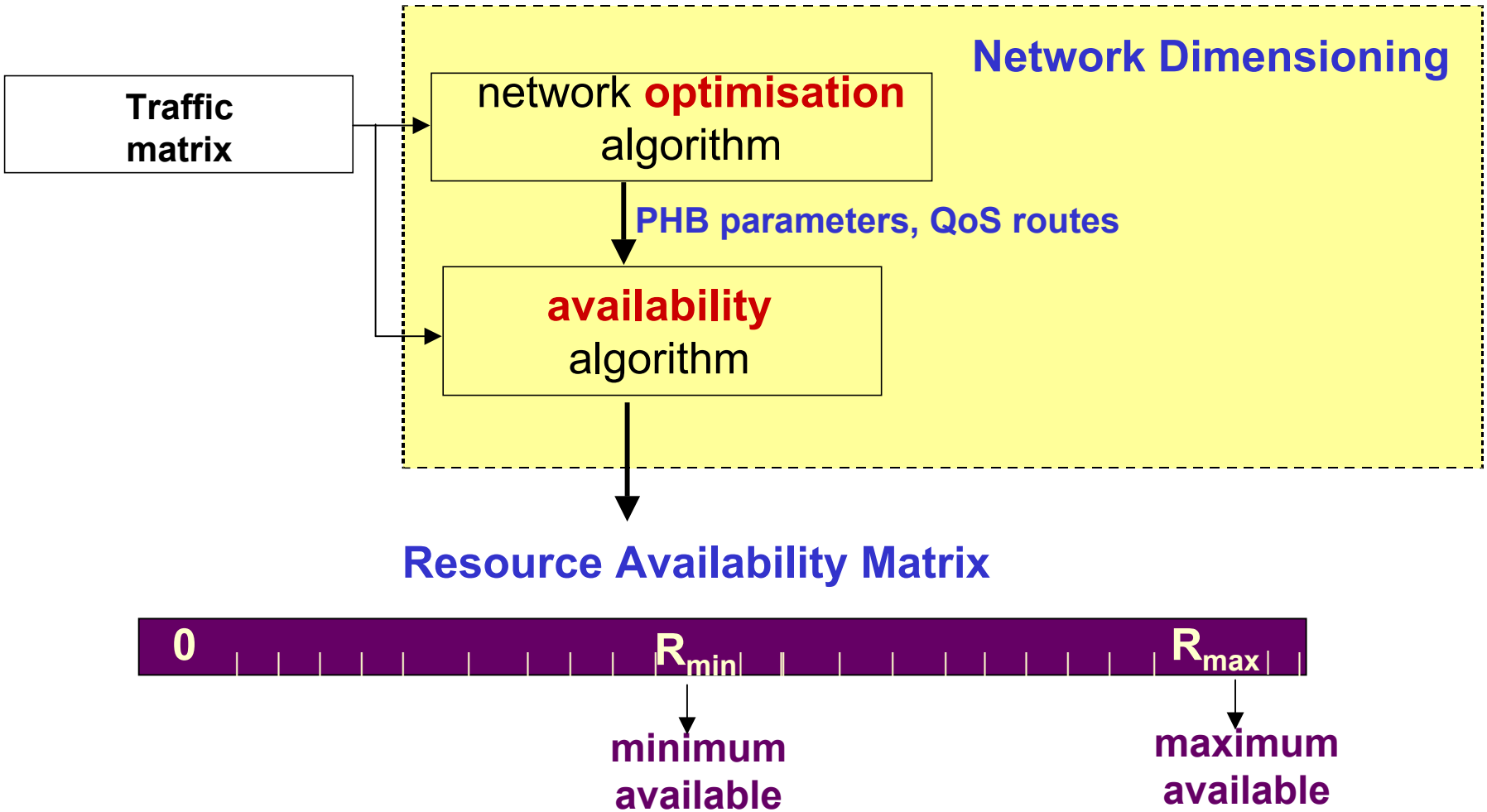


Estimating the Traffic Matrix

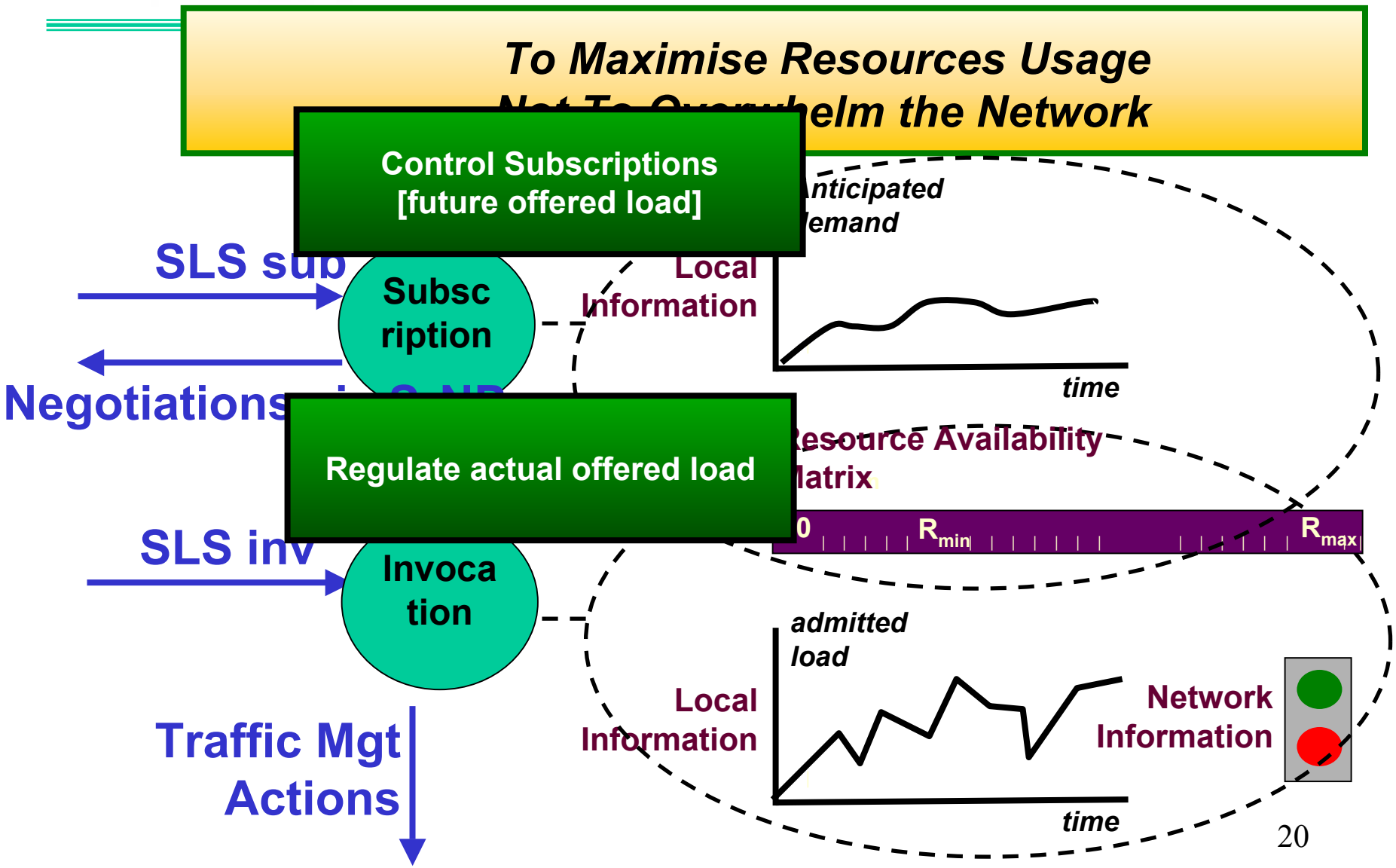


[QoS class | ingress-egress | min-demand - max-demand]

Generating the Resource Availability Matrix

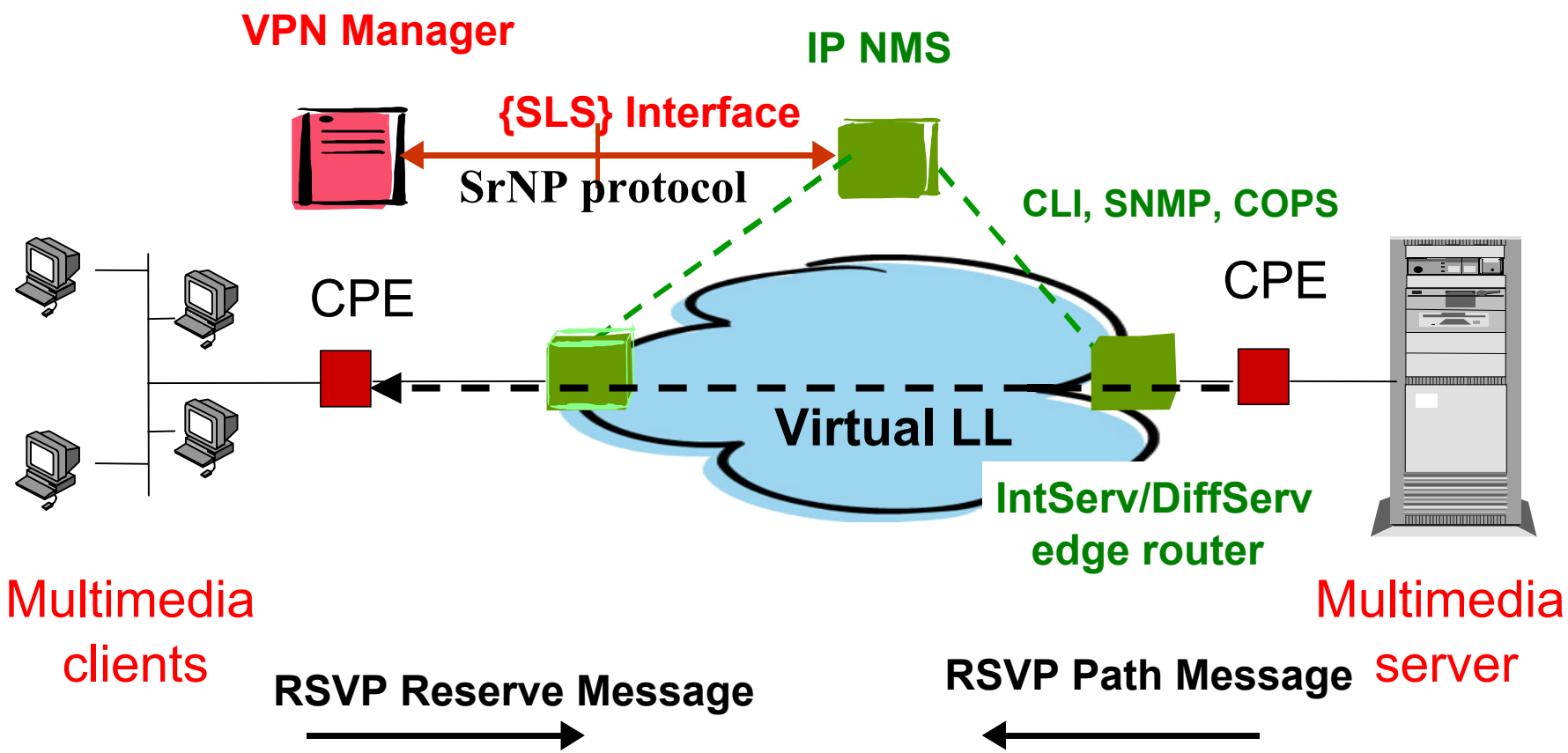


Two-level Admission Control

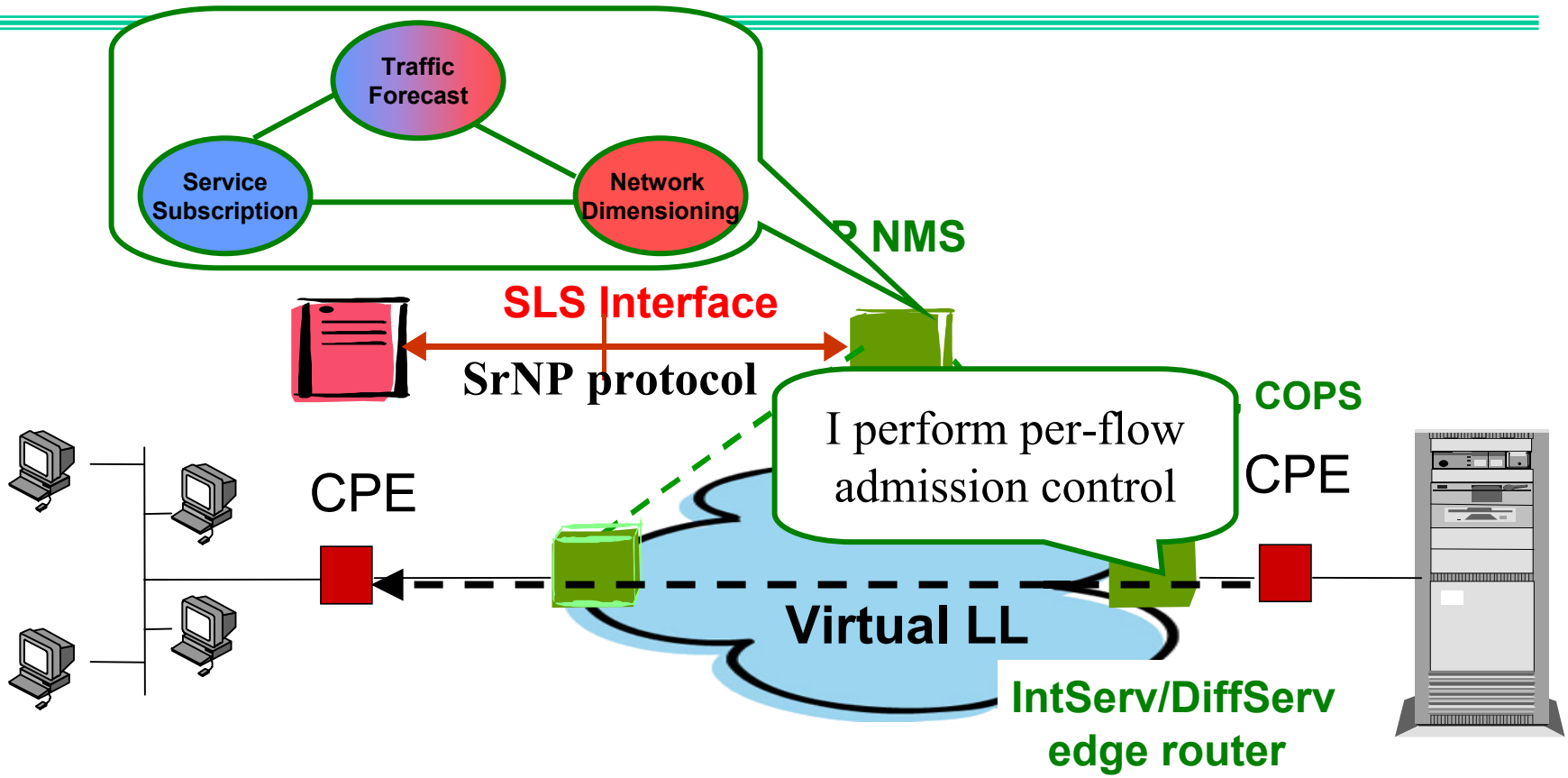


Part 4
The TEQUILA Model Illustrated

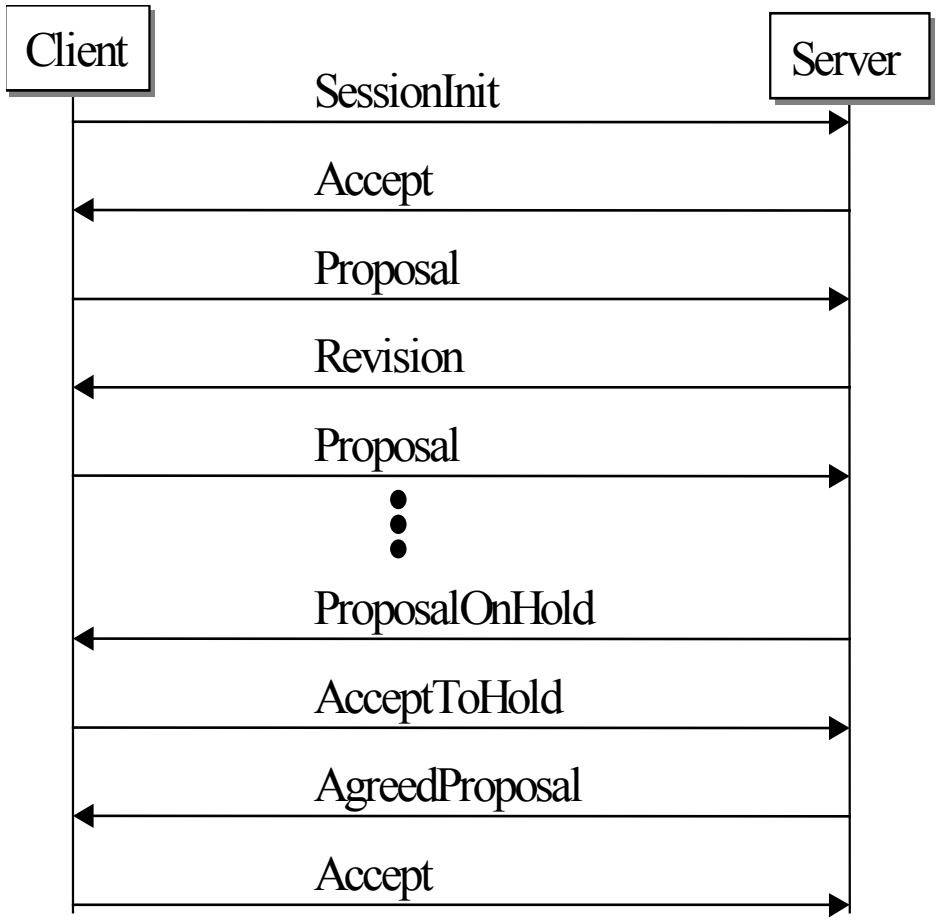
Multiplexing Multimedia in a VLL



Multiplexing Multimedia in a VLL



Service Negotiation Protocol - SrNP

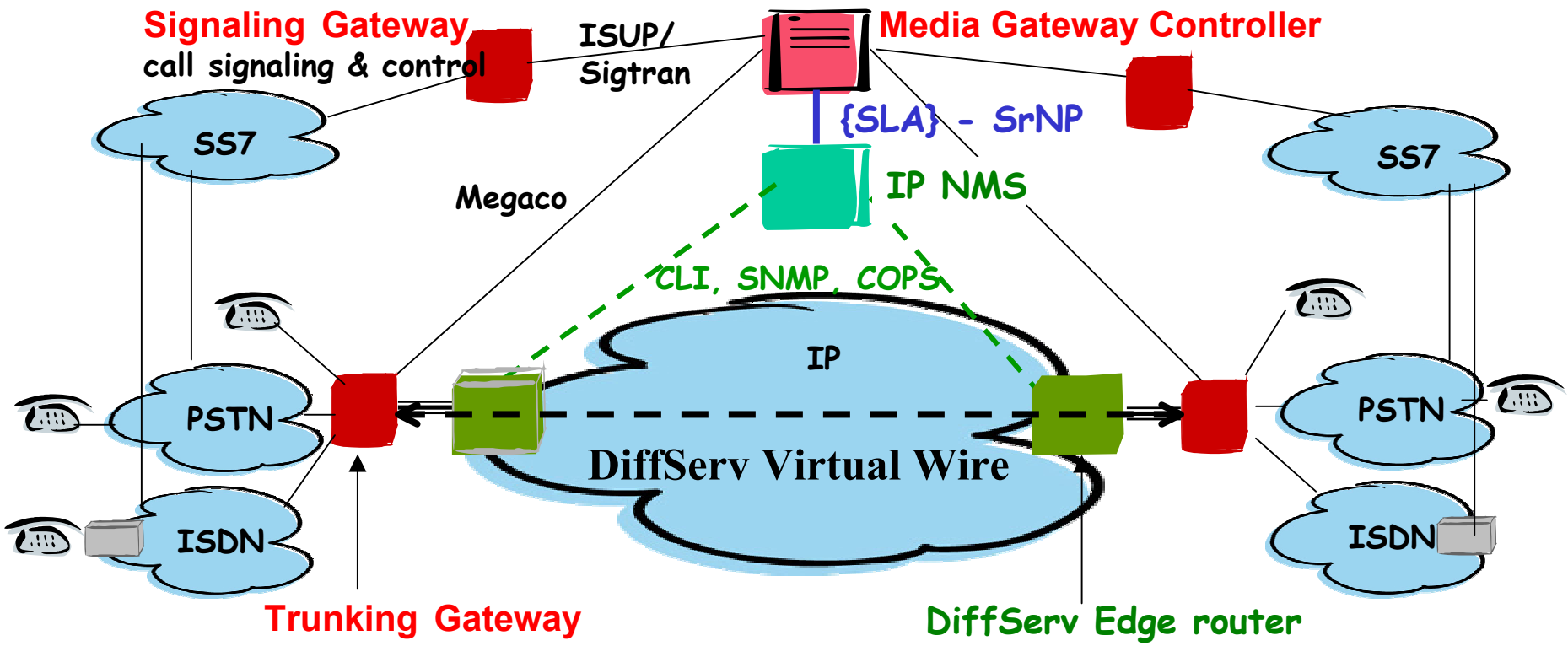


- Client-server based
- Form-fill oriented
- Messaging is content-independent
- Protocol stacks

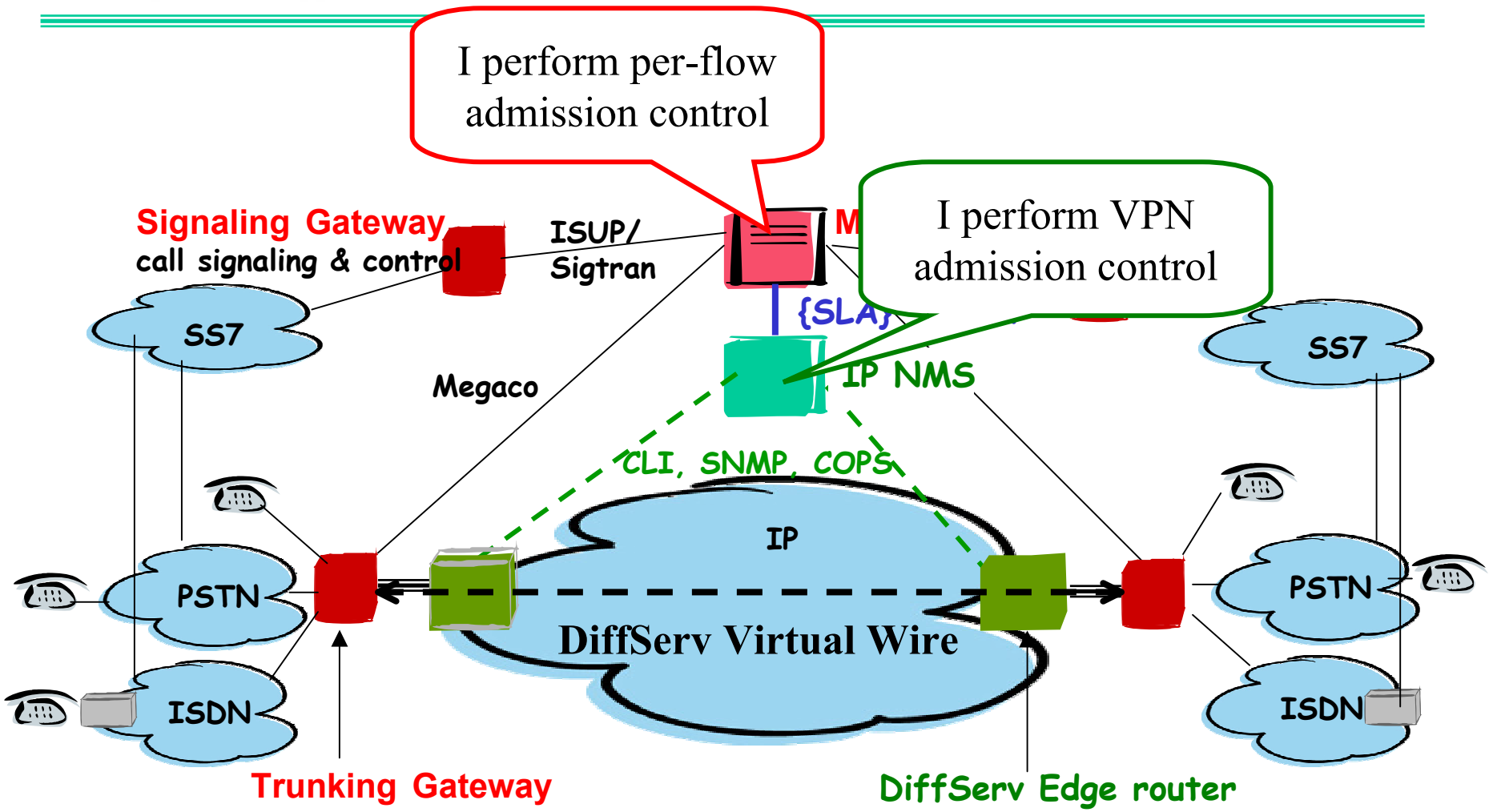
SrNP
XML
HTTP,SMTP,IIOP
TCP/IP

SrNP
TCP/IP

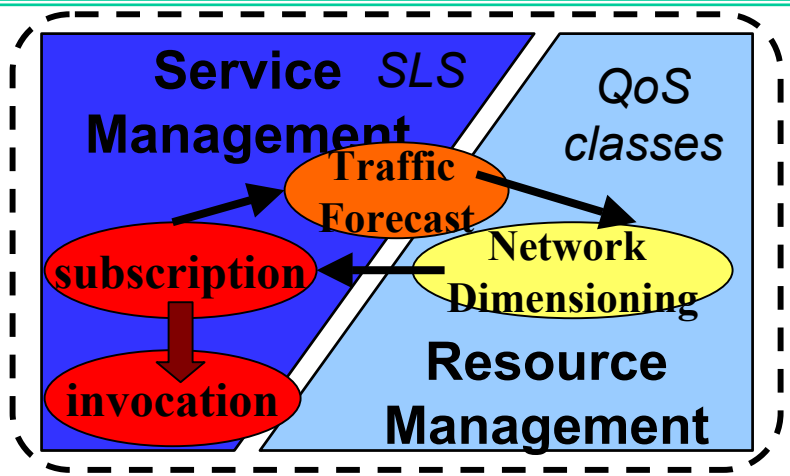
Connecting Trunking Gateways



Connecting Trunking Gateways



Conclusions



- Clear separation of service & resource management
  - service system: only *edge-to-edge* view on the network
  - resource system: only QoS class aware (*no SLS-awareness*)
- Two-level admission control
  - long-term IP aggregates based on *resource provisioning cycle*
  - short-term flows based on long-term guidelines