End-to-End Quality of Service in Mixed IP & Circuit Switched Network

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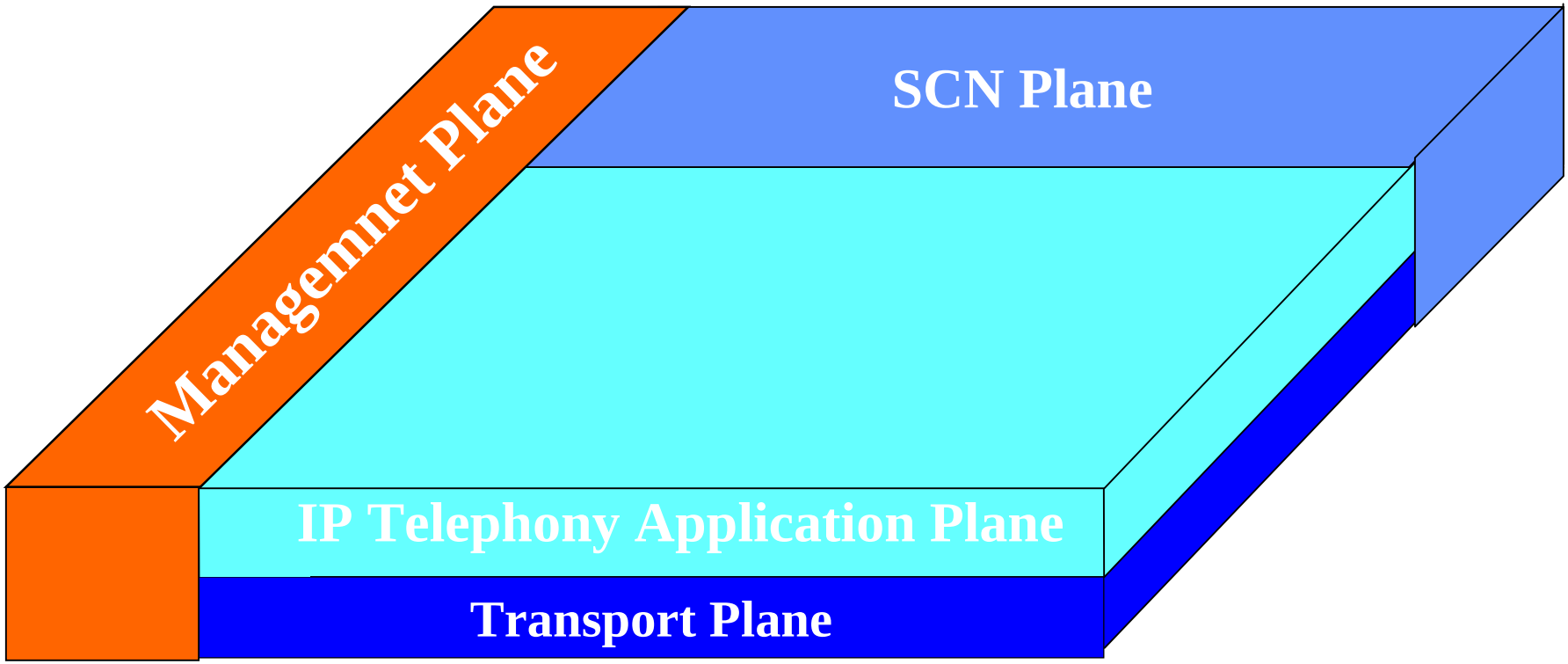
Bell Labs Innovations

Delivering QoS End-to-end

General TIPHON Architecture



Components of a QoS Architecture

Application Plane

- Within this plane, QoS parameters specific to the application (e.g. QoS class, speech quality, end to end delay) are requested, authorised, signalled, controlled and accounted.

IP Transport Plane

- Within this plane, general non-application specific parameters effecting QoS, (e.g. end-to-end delay, delay jitter, packet loss and bandwidth) must be controlled and accounted to achieve the QoS requirements requested by the application.

Components of a QoS Architecture

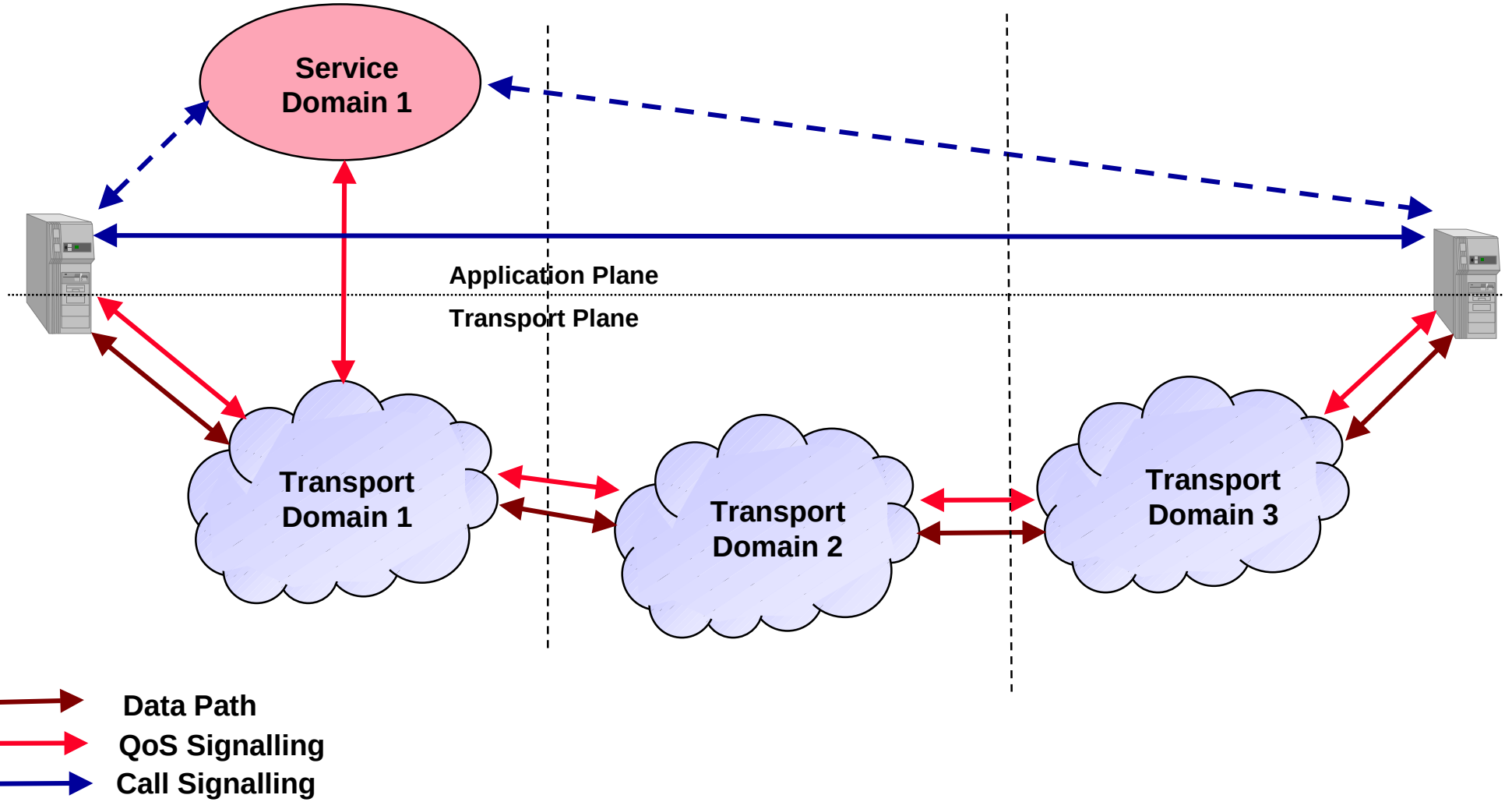
Service Domain

- A Service Domain is a set of application resources under the control of a Service Provider.

Transport Domain

- A Transport Domain is a set of transport resources that offer a single set of policies under the control of a single Transport Resource Manager Function.

QoS Conventional Model



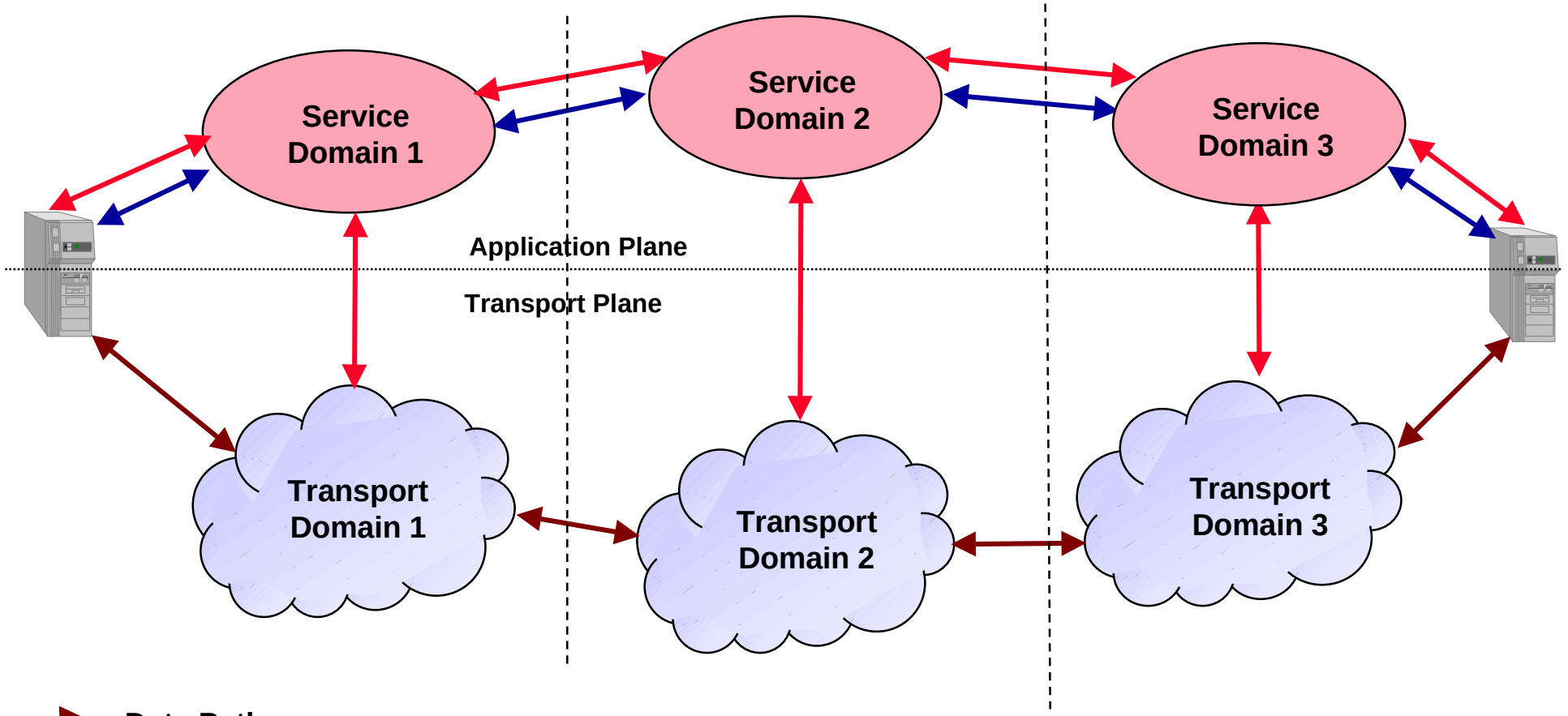
TIPHON Model Assumptions

- A call may traverse several transport domains
- Each transport domain may have its own address space
- Firewalls may be present between transport domains
- Transport domains may support different QoS mechanisms and policies
- Routing of calls between transport domains will be under the control of the Application Plane (one or more service providers)
- Routing of calls within transport domains will be independent of the Application Plane

General appoach to Controlling End-to-end QoS

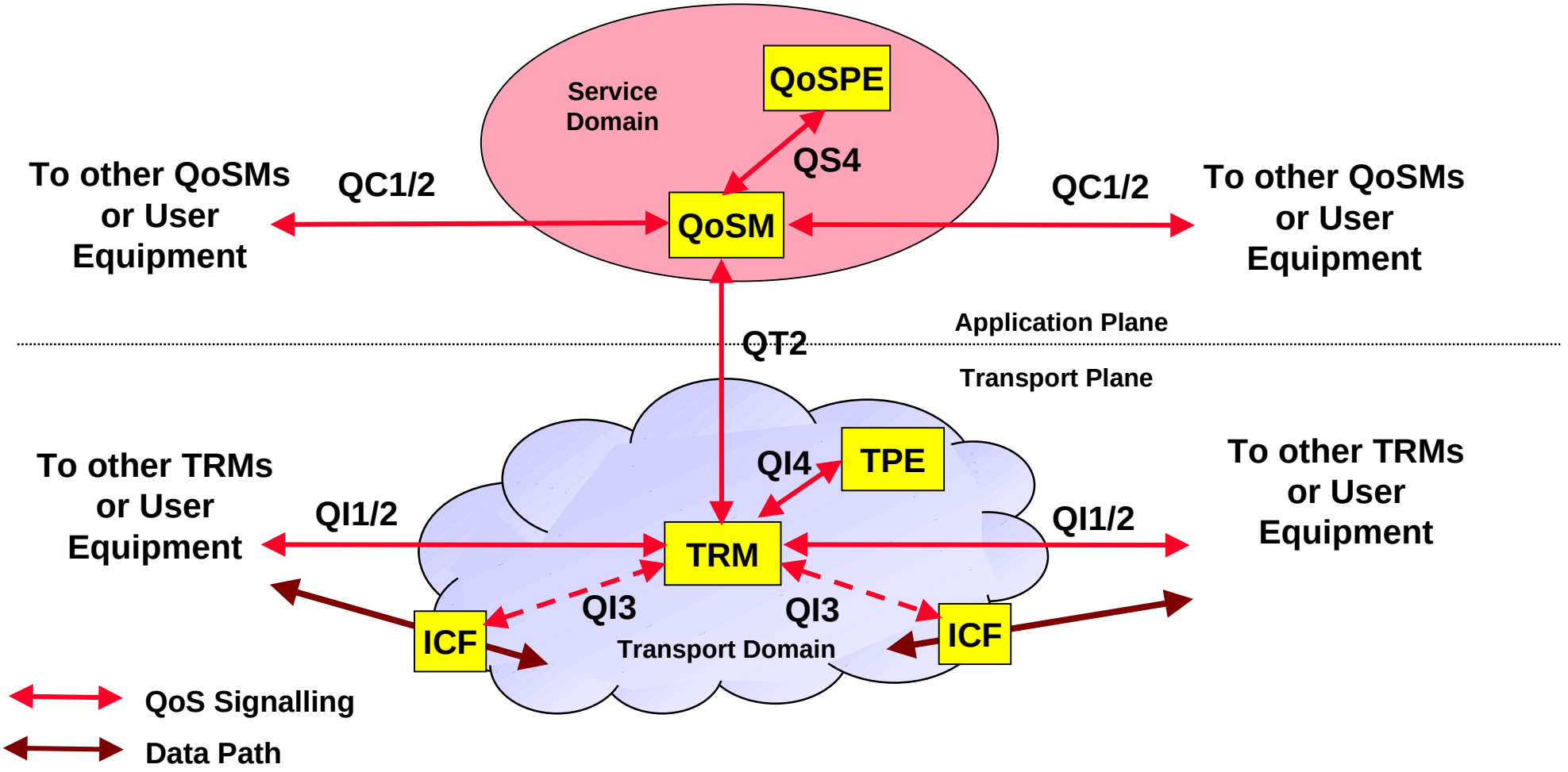
- Required end-to-end QoS levels are established within the Application Plane (Between User and Service Provider(s))
- Decisions determining QoS, specific to the application, will take place in the Application Plane (e.g. codec type, packetisation etc)
- End-to-end (inter-domain) QoS control takes place within the Application Plane. (Between Service Providers)
- Transport domains (Operators) provide a QoS service to the associated Service Domains (Service Providers)
- QoS control within a Transport Domain is the responsibility of the Operator of that domain
- A common interface can be defined between a Transport Domain and its associated Service Domain even though different QoS mechanisms may be present within the Transport Plane.

TIPHON QoS General Model



QoS Functional Entities

Relationship between QoS Functional Entities & Domains



QoS Functional Entities

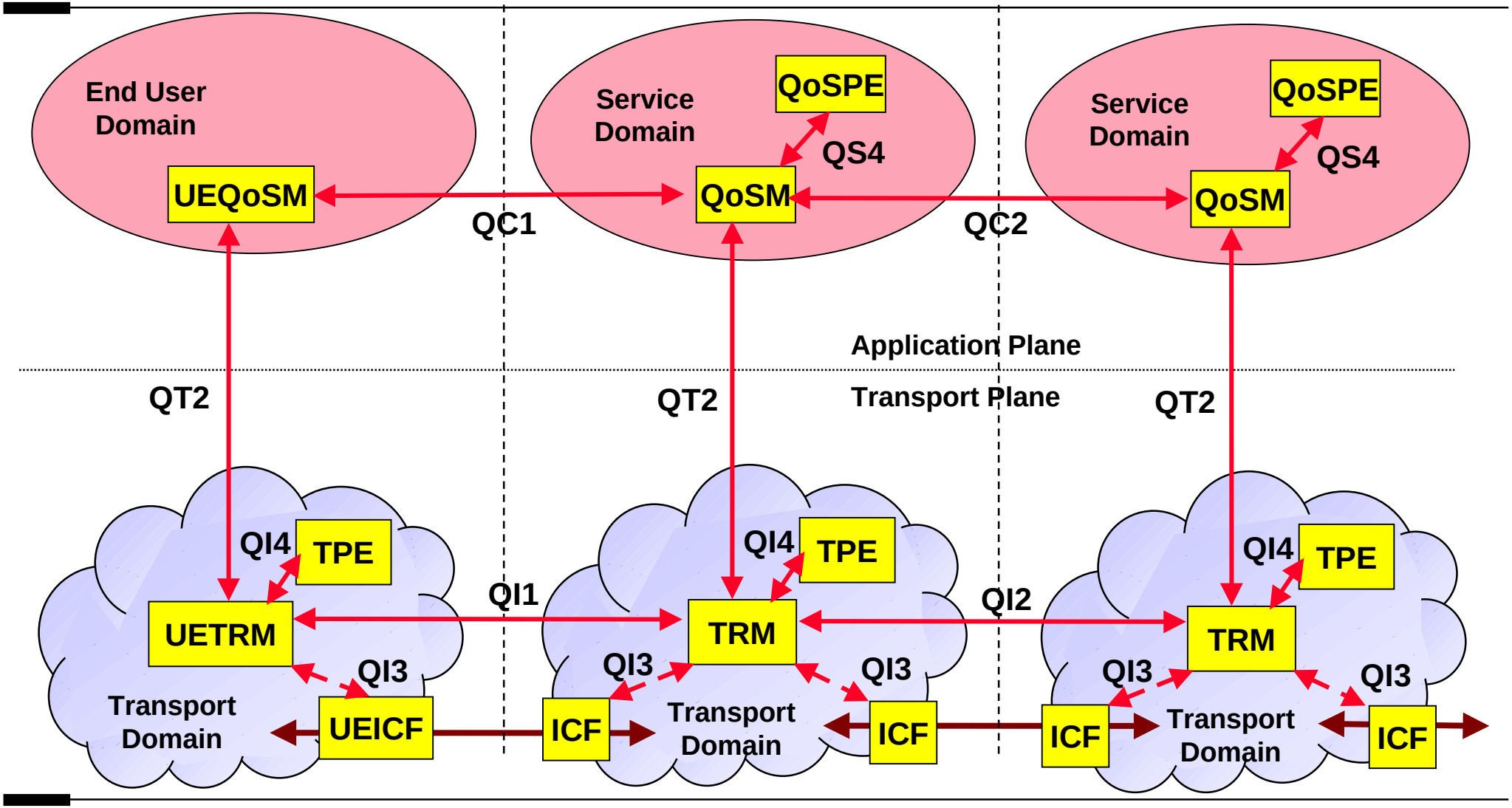
Application Plane

- QoS Policy Entity (QoSPE). An entity that manages policies and provides authorisation of permitted and default QoS levels. It receives requests from and issues responses to QoSMs to establish the authorised end to end QoS levels.
- QoS Service Manager (QoSM). An entity that mediates requests for end to end QoS in accordance with policy determined by the QoSPE. It communicates with User Equipment, other QoSMs and with RPMs to determine, establish and control the offered QoS.

Transport Plane

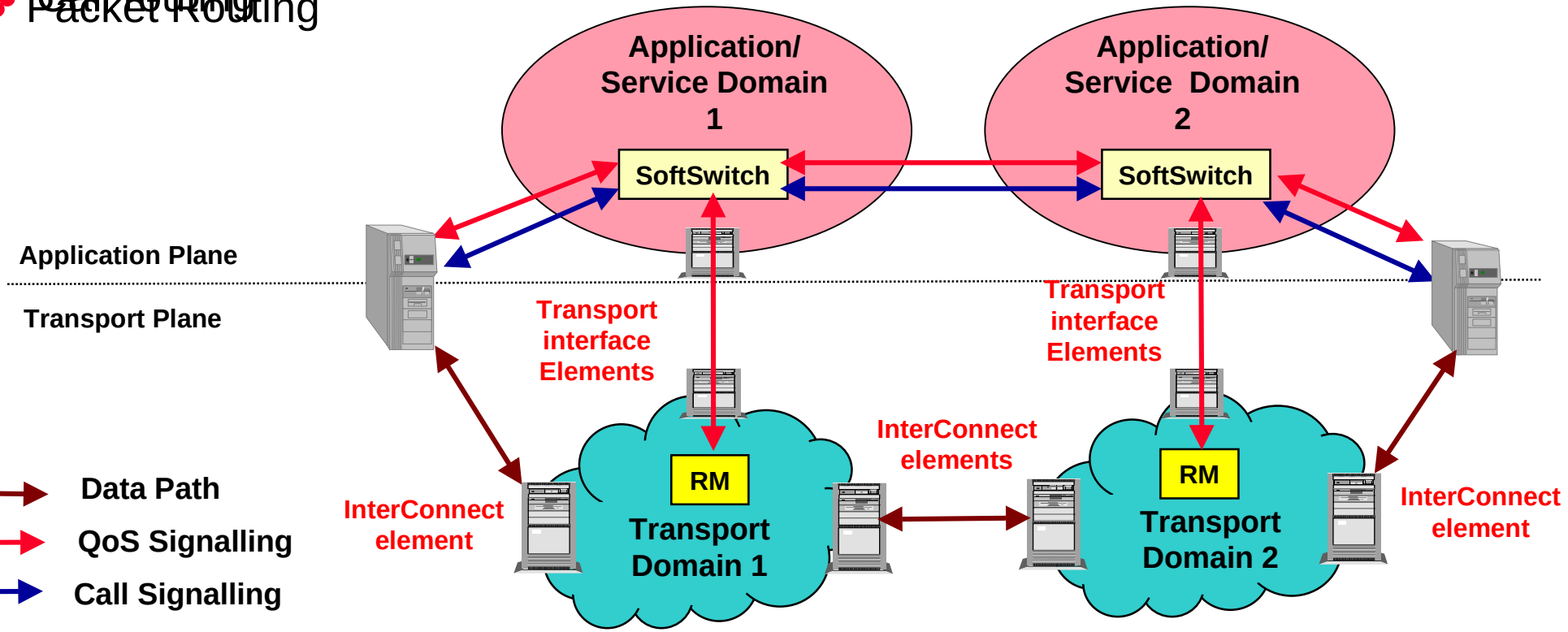
- Transport Resource Manager (TRM). An entity that applies a set of policies and procedures to a set of transport resources to ensure that those resources are allocated to enable QoS quarantees across the domain of control of the RM.
- QoS Transport Policy Entity (QoSTPE). An entity that manages policies and provides authorisation of permitted and default QoS levels. It receives requests from, and issues responses to, TRMs to establish the authorised end-to-end QoS levels.
- Interconnect Function (ICF). An entity that polices authorised media flows within a Transport Domains to ensure they are consistent with the QoS policy specified by the Transport Resource Manager.

Relationship between QoS Functional Entities & Domains



QoS Control Model (Summary)

- Application Domains "lease" transport capacity
- Transport domains provide transport capacity
- Take care of call admission
- Take care of packet admission
- Call routing
- Packet Routing



Characterizing QoS

Characterizing QoS

User Level

- TIPHON QoS classes

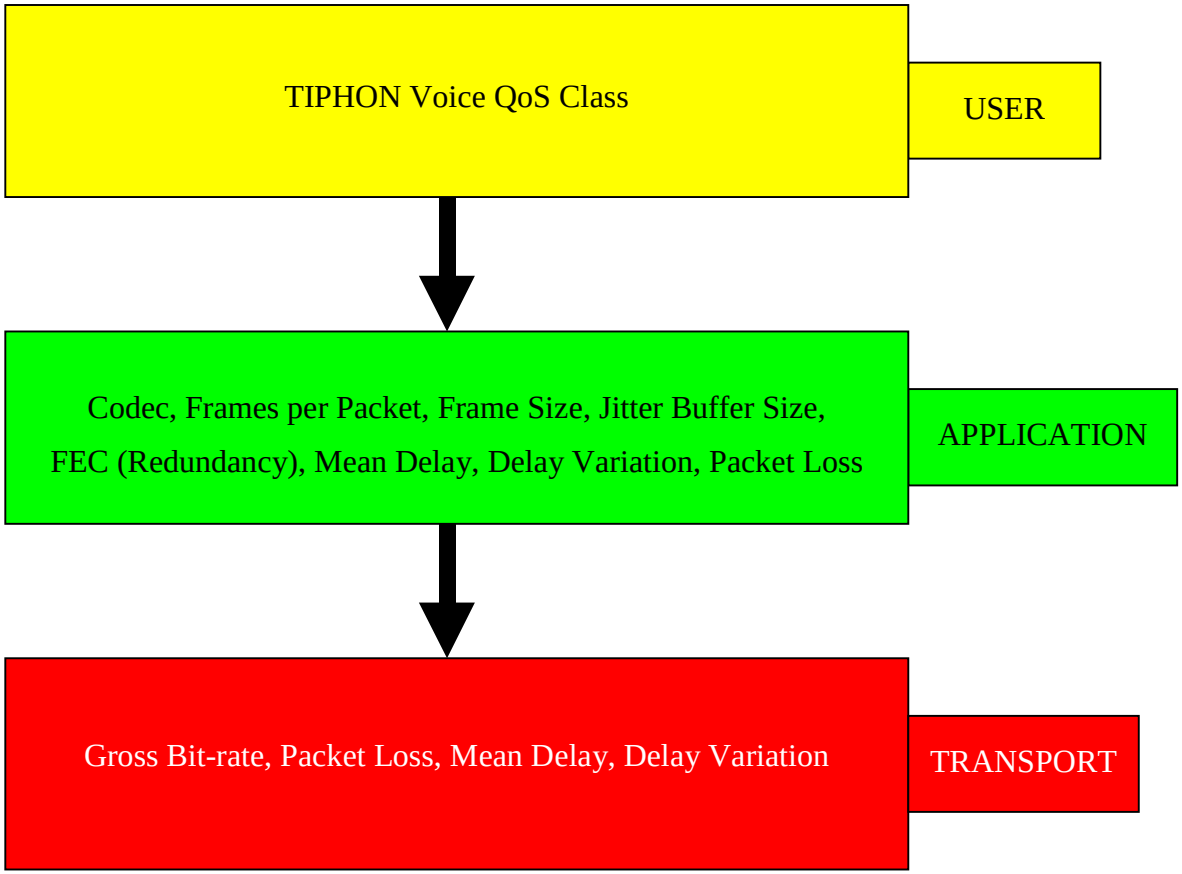
Application Level

- choice of codec, packetisation, codec frame size, the algorithms used for handling packet delay variation at the receiver, codec error concealment, equipment delays

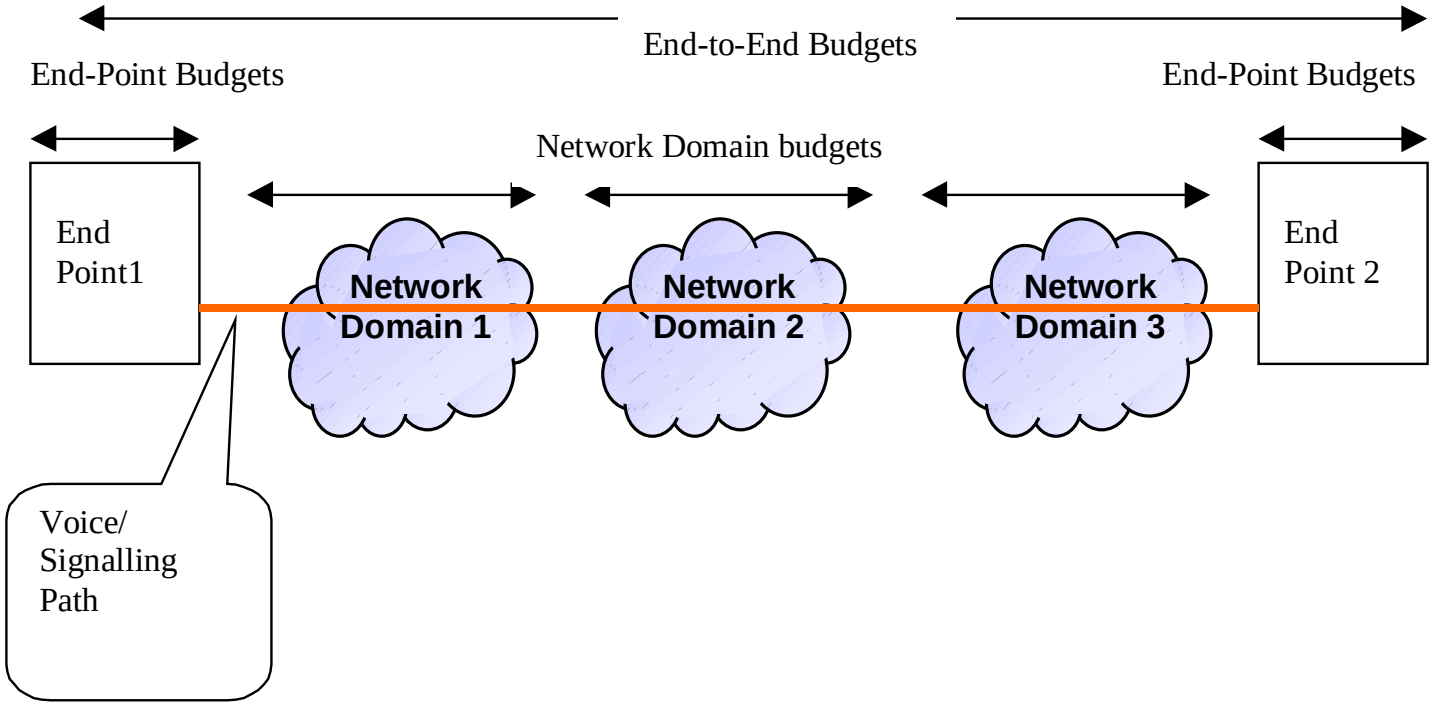
Transport Level

- gross bit rate, mean end to end delay, delay variation and packet loss.

QoS Parameters



The Concept of QoS Budgets



Allocating QoS Budgets

Approach to Allocating Budgets

Static Service Level Agreement (SLA)

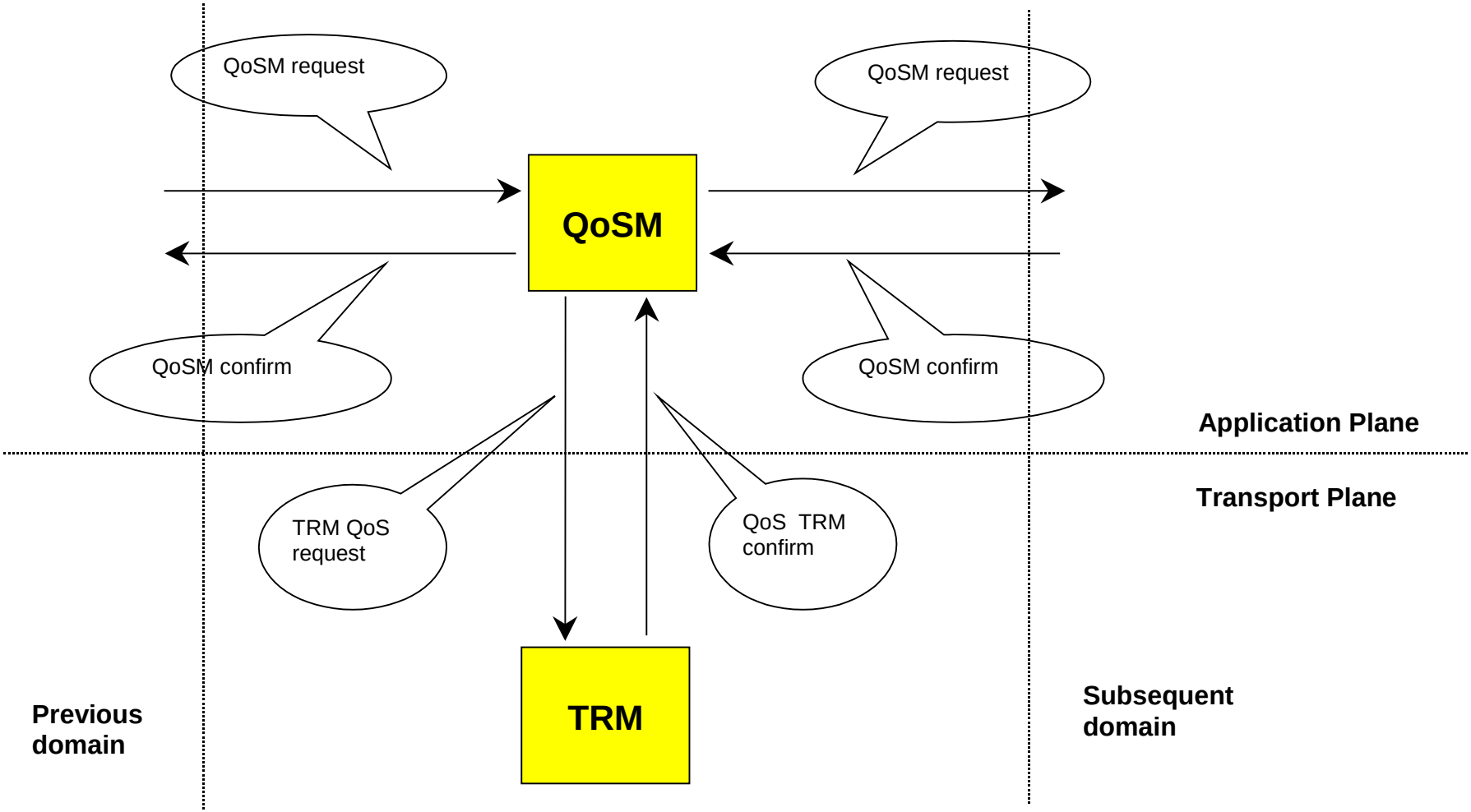
- Agreements between Service Providers, and between Service Providers and Network Operators, specify default limits on QoS parameter values for all calls,
- The maximum number of permissible network domains end-to-end, and
- The User Equipment QoS characteristics are recorded by the Service Provider at registration as part of the User Profile.

Approach to Allocating Budgets

Dynamic Signalling

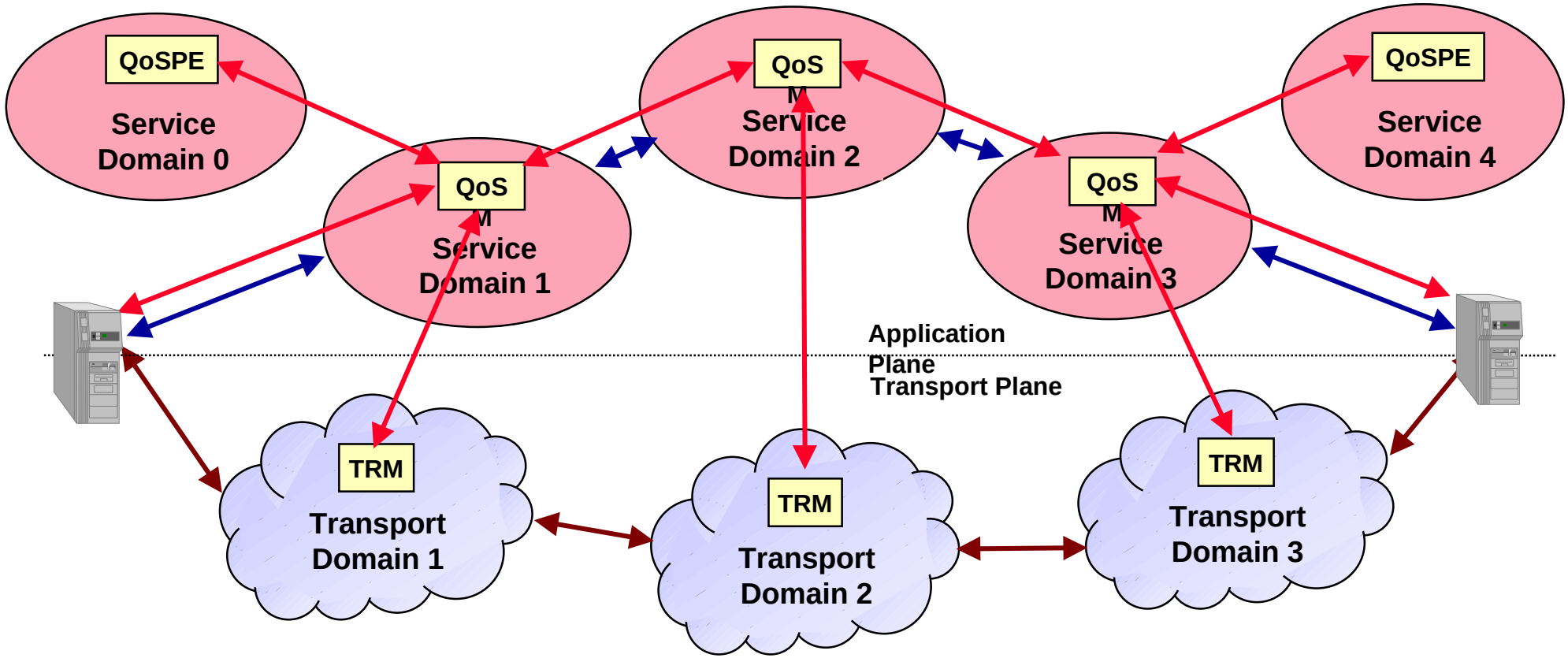
- Agreements between Service Providers, and between Service Providers and Network Operators, allow for limits on QoS parameter values to be specified per call,
- May be simplified by grouping into Classes and Signalling Classes,
- User equipment QoS characteristics may be registration as part of User Profile or signalled by User per call.

QoS Information Flows



Roaming

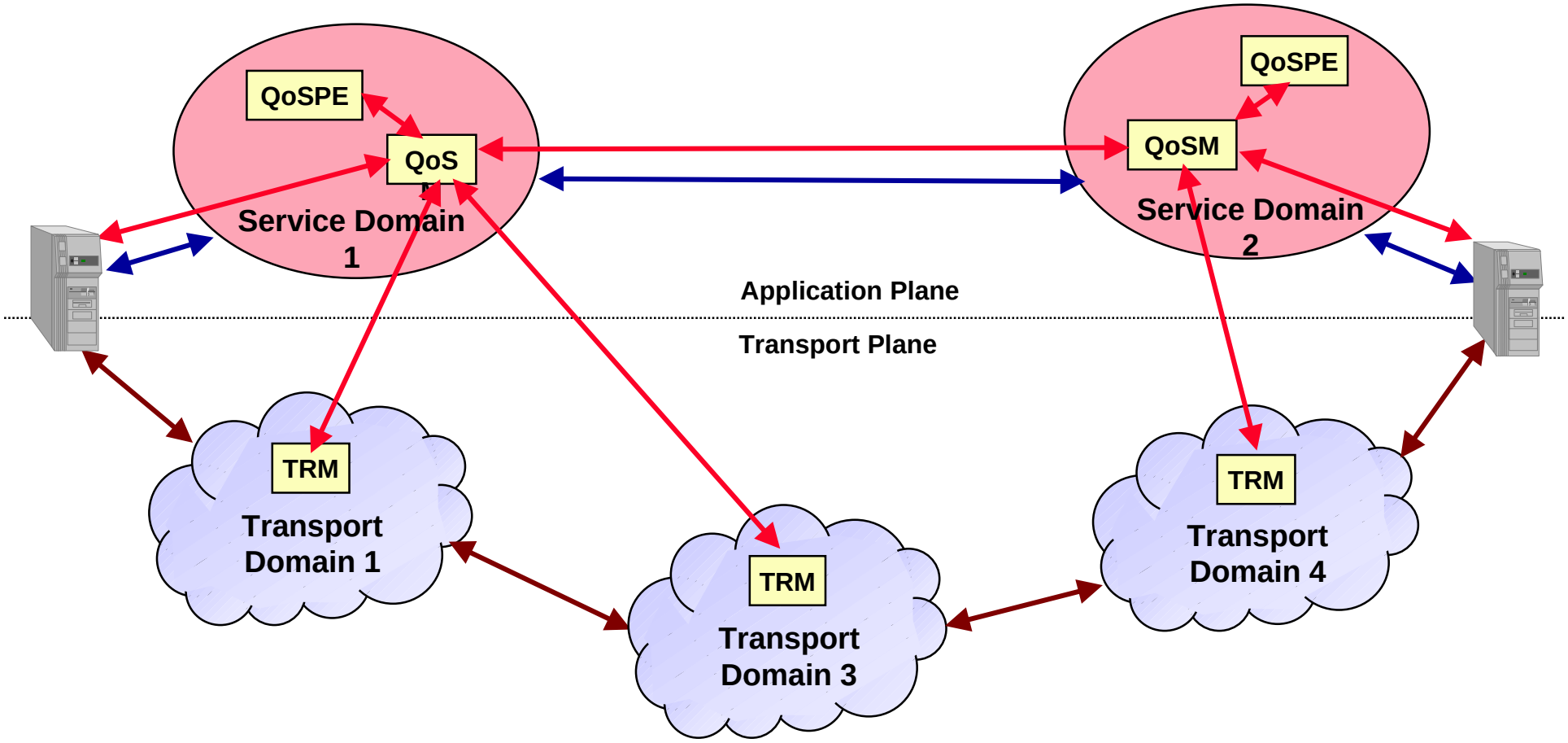
QoS Control Model - Roaming



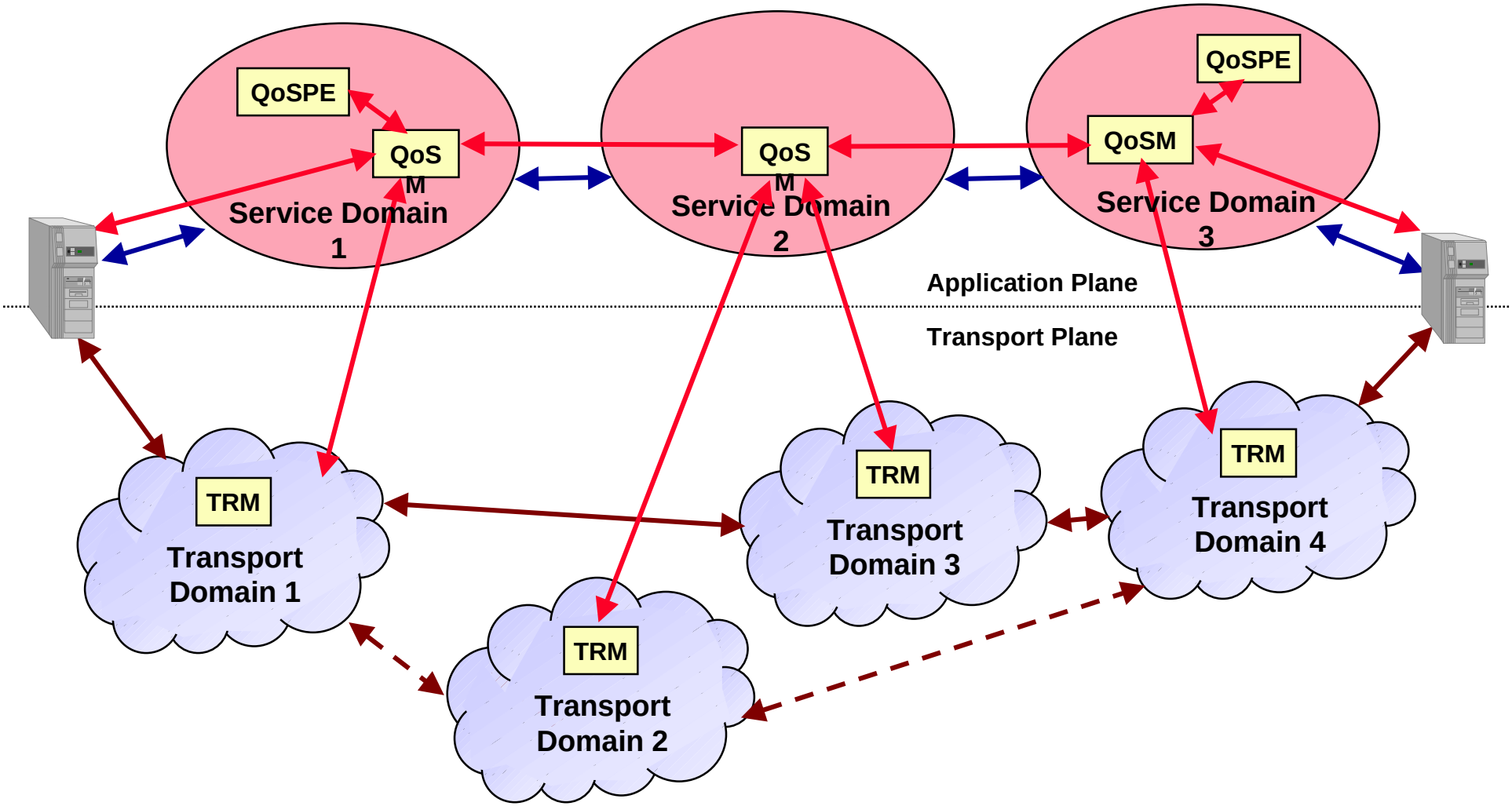
Inter-Domain Routing

Possibilities

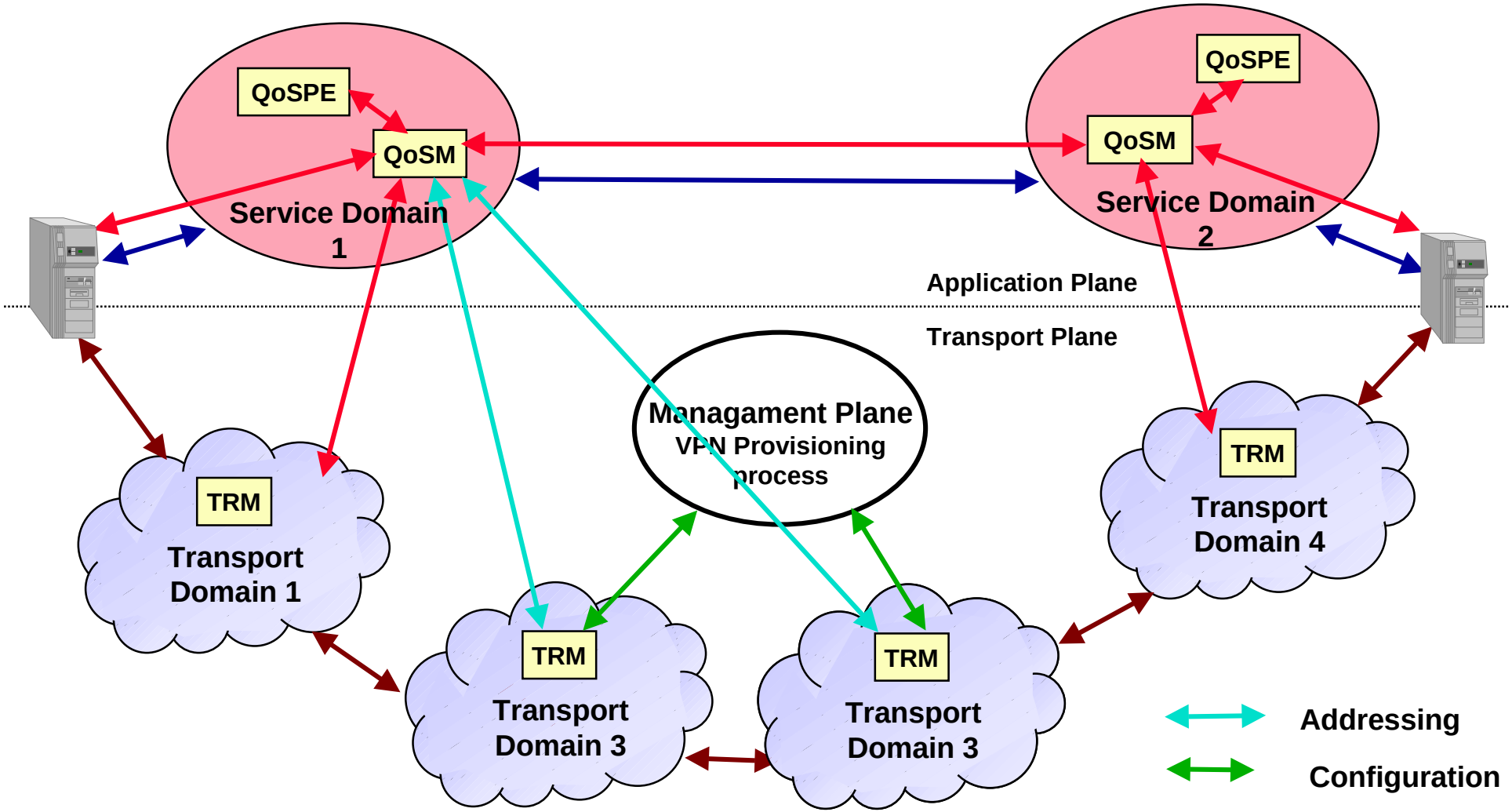
QoS Control Model - Multiple Domain Control



QoS Control Model - Alternate Routing



QoS Control Model - VPN

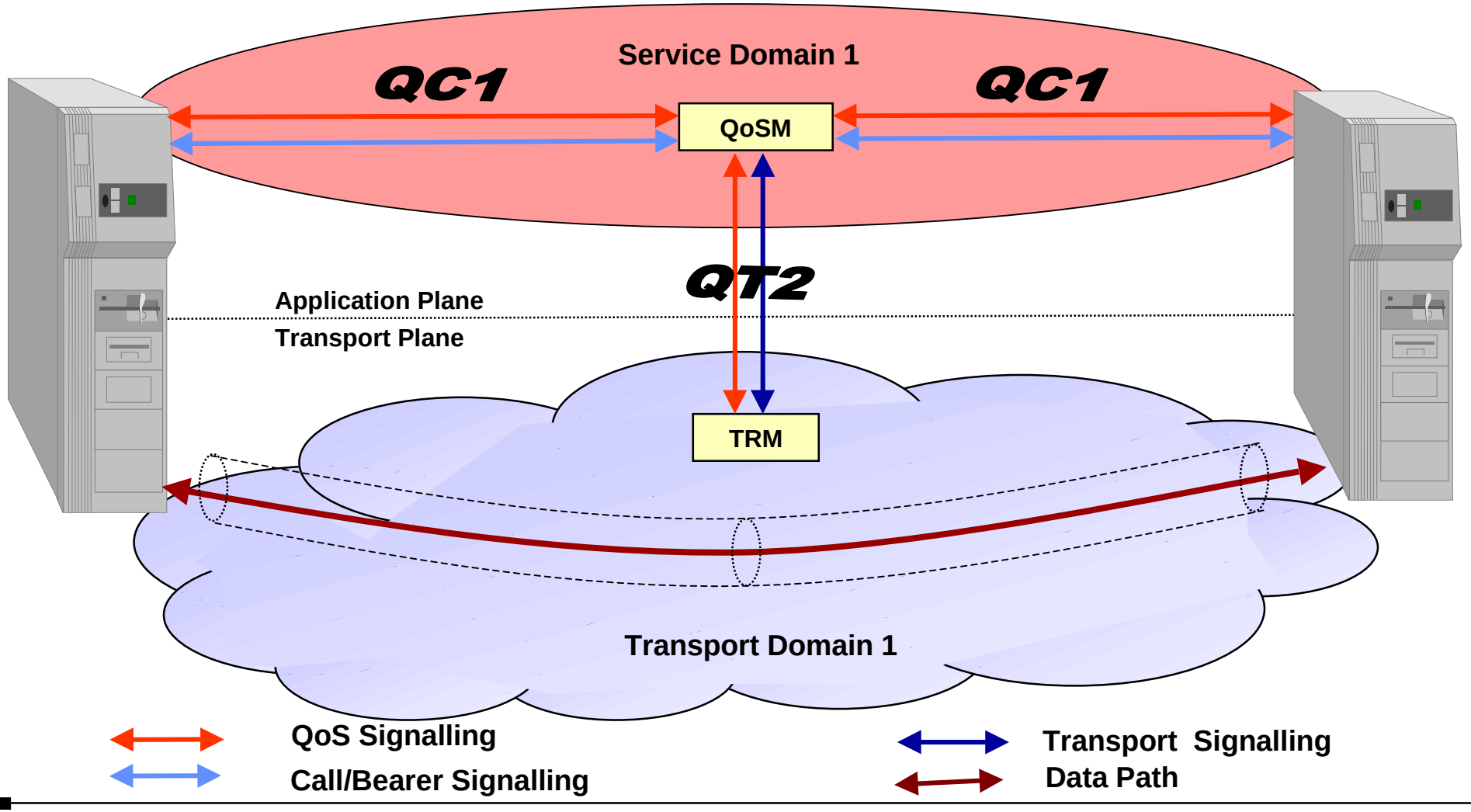


Resource Aggregation

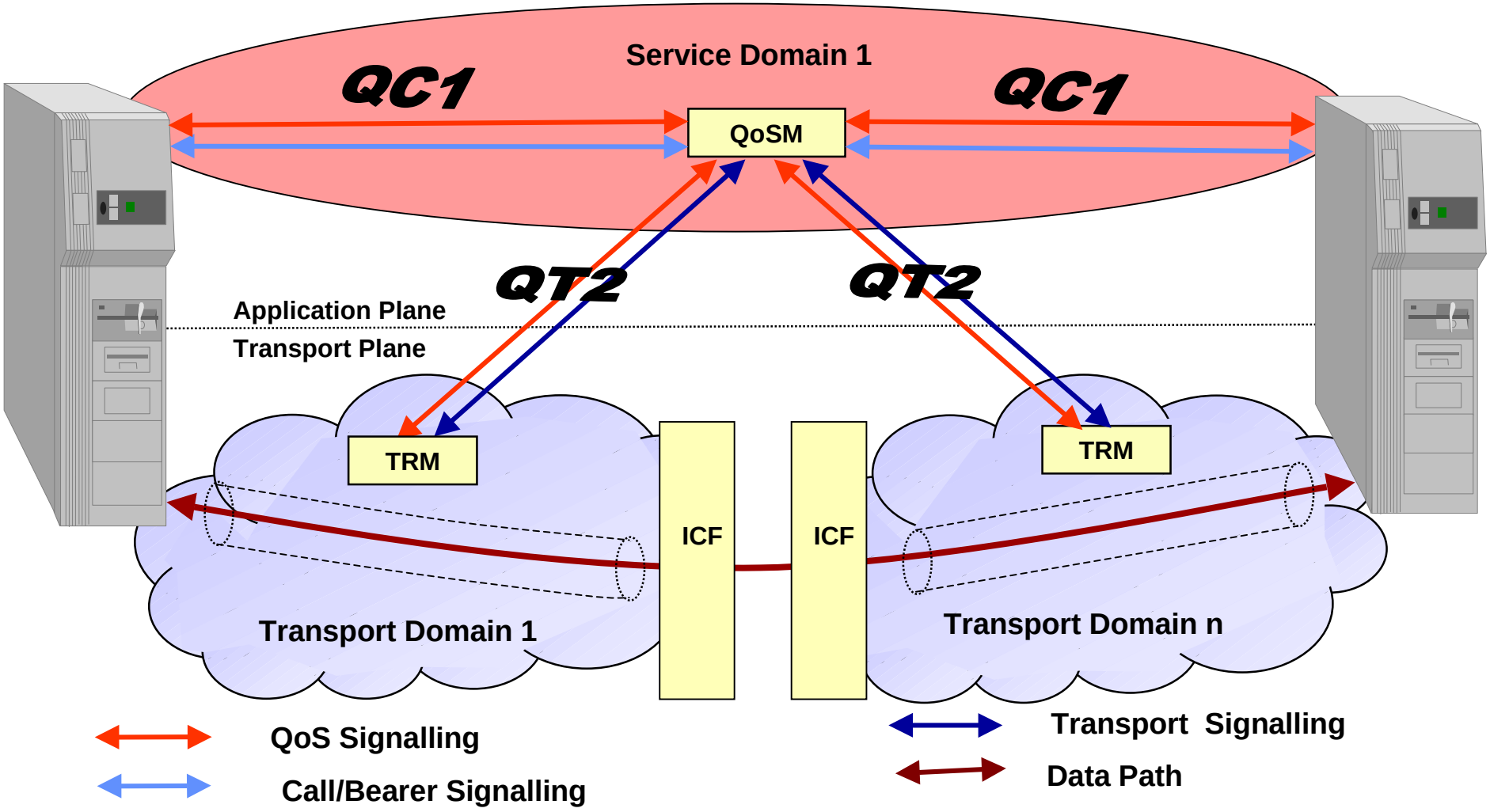
Aggregation

- Per call interrogation of resource availability in transport plane is probably unnecessary and periodic information exchange will suffice,
- Aggregation of transport resource will take place in both Application and Transport Planes.

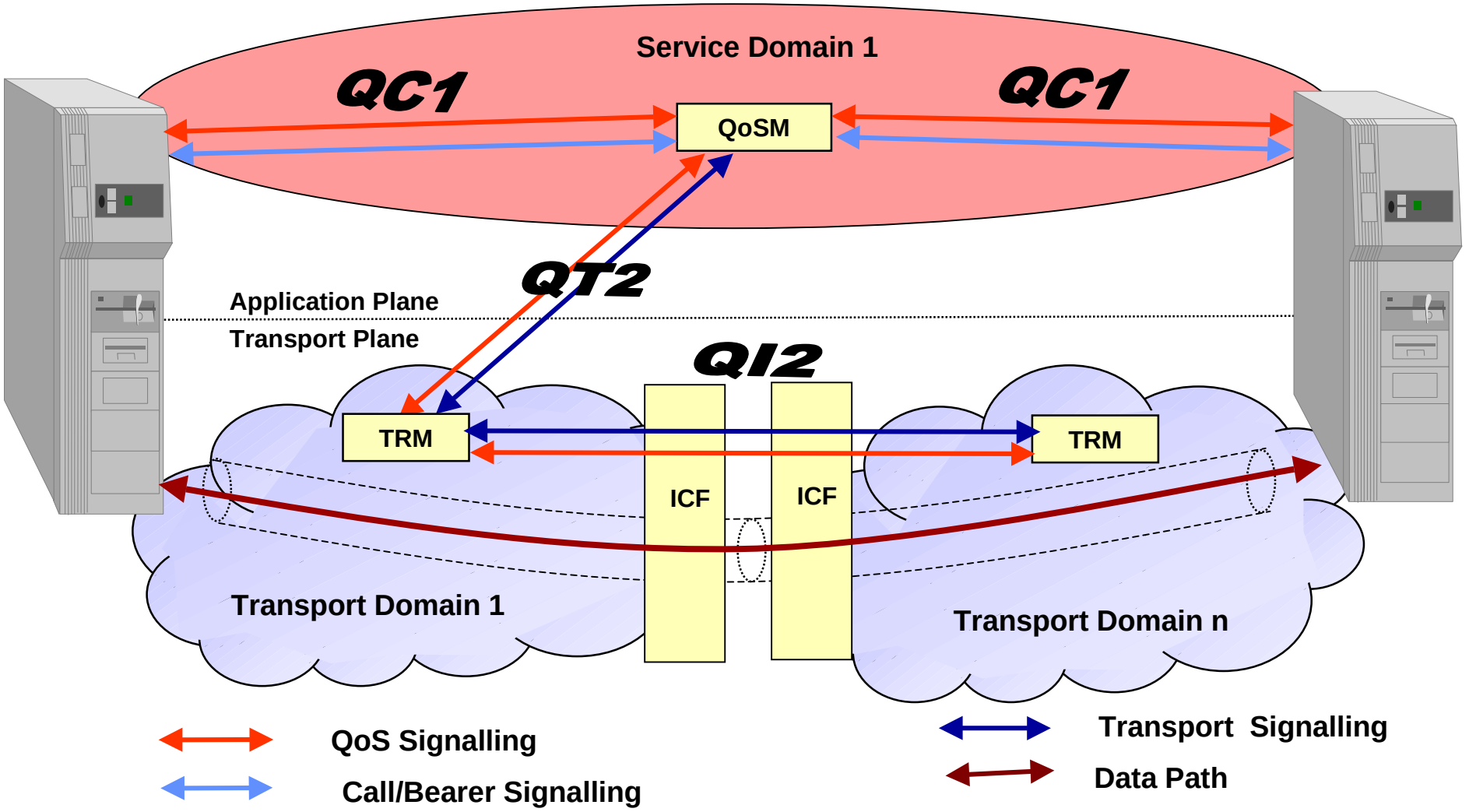
Bandwidth Aggregation 1



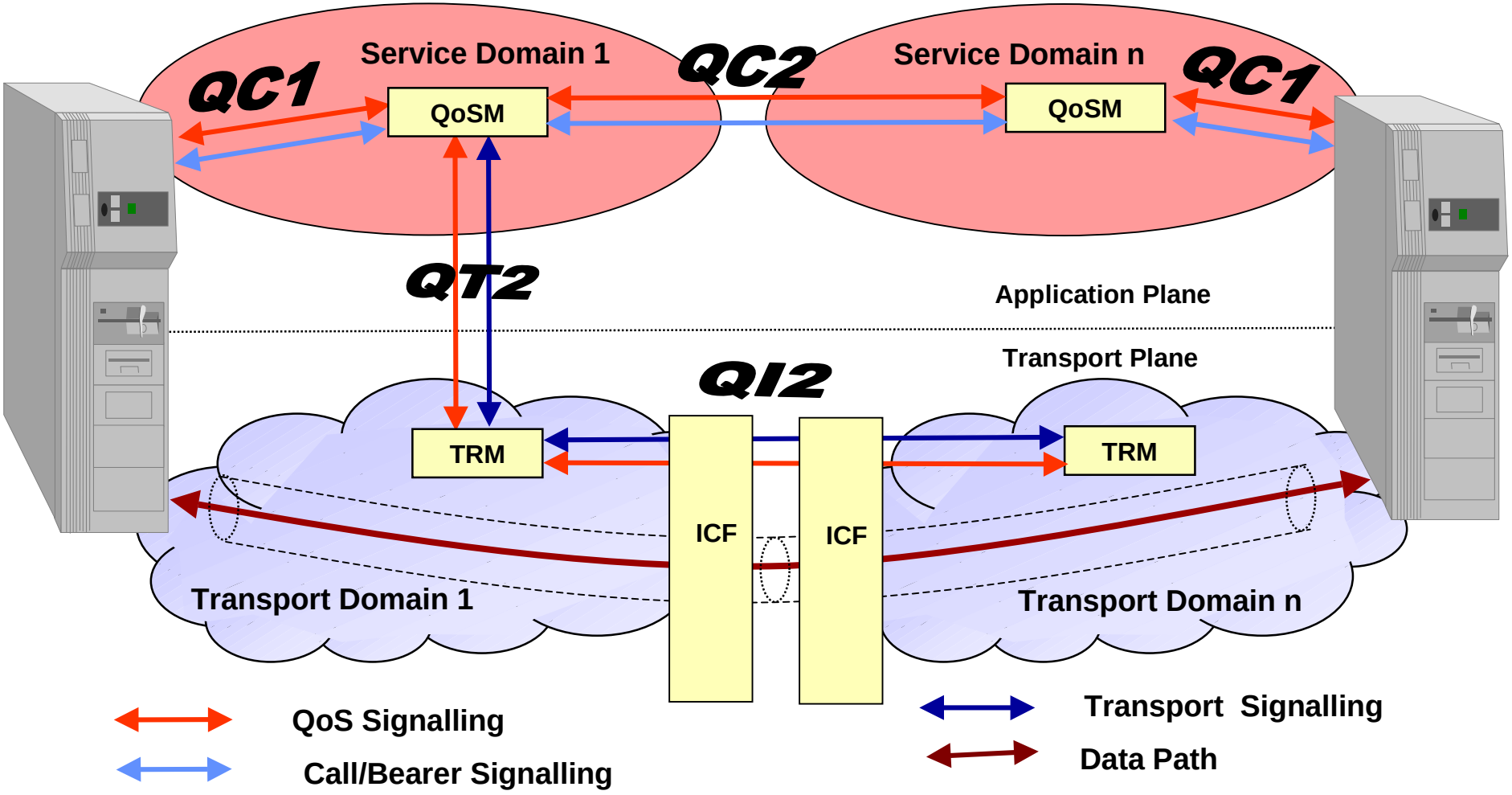
Bandwidth Aggregation 2



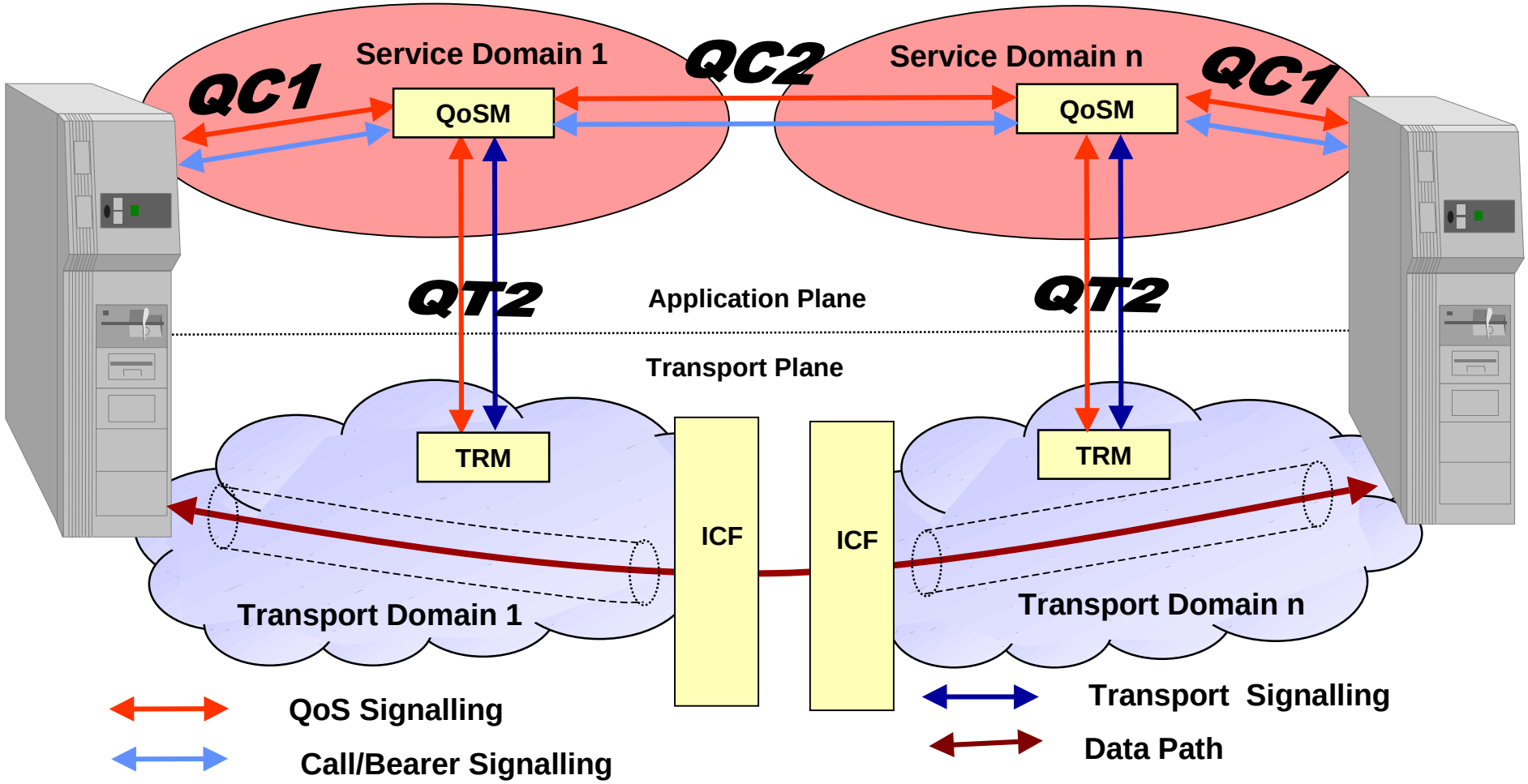
Bandwidth Aggregation 3



Bandwidth Aggregation 4



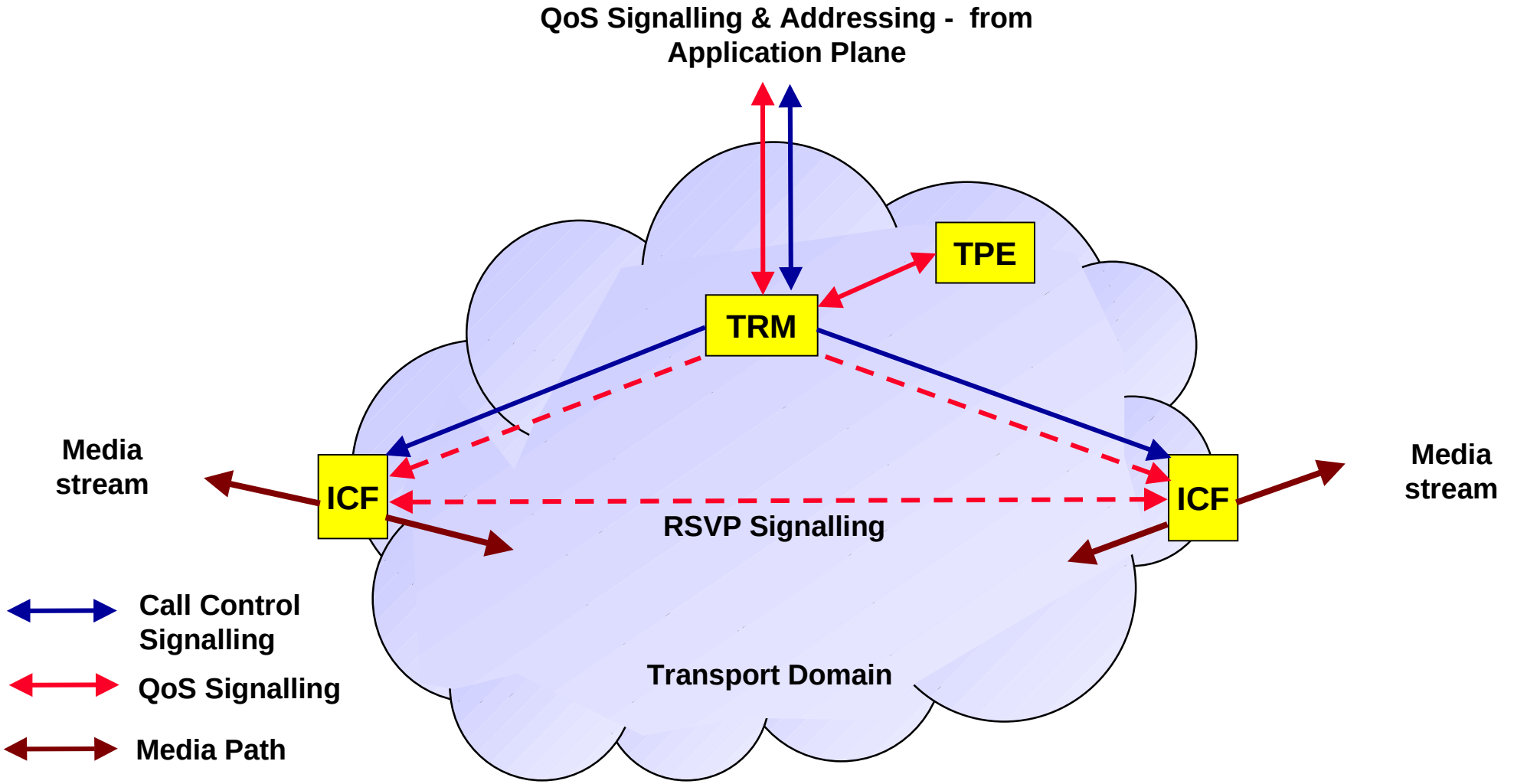
Bandwidth Aggregation 5



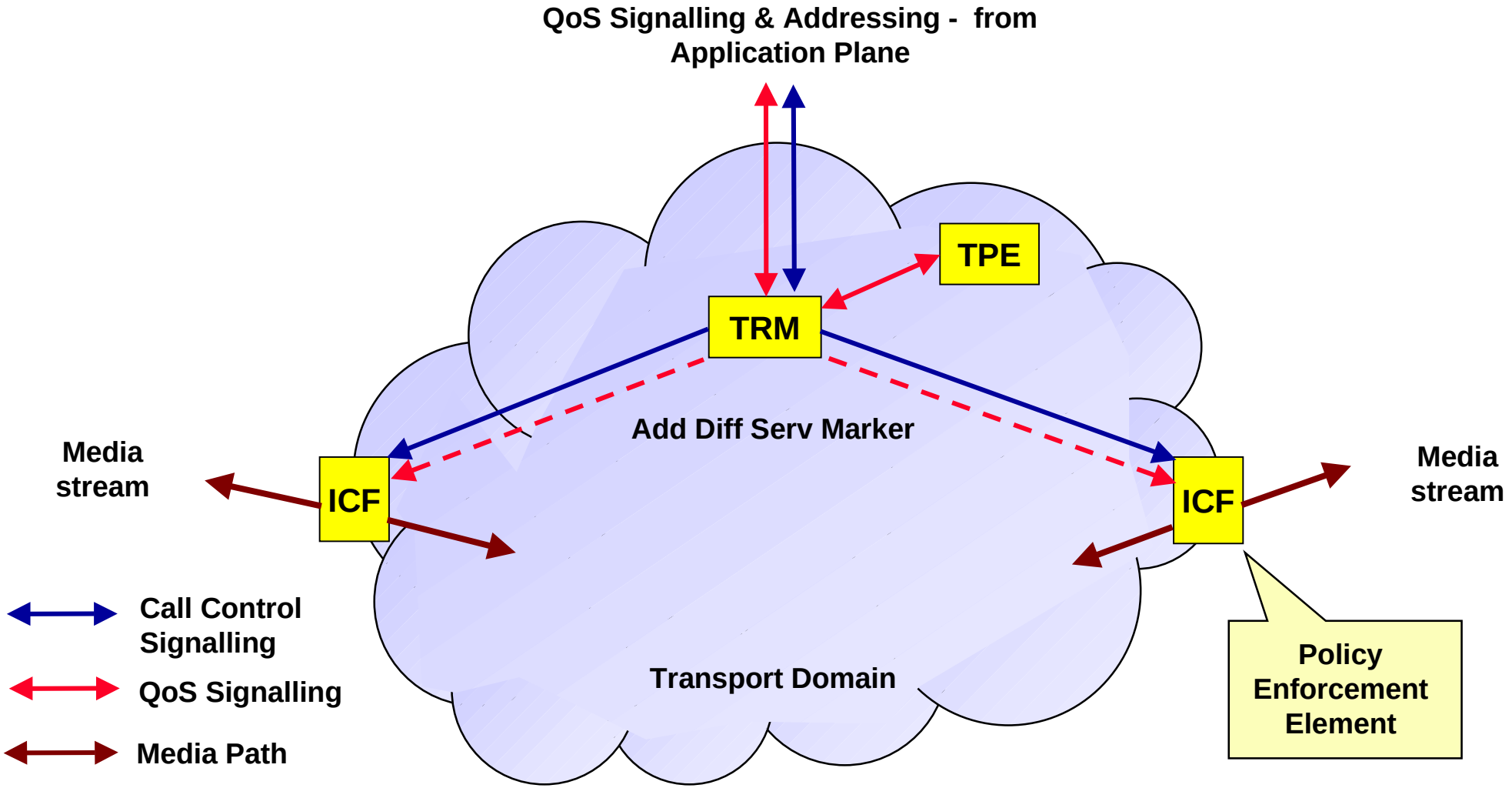
Transport-Domain QoS

Control

RSVP


QoS Signalling & Addressing - from Application Plane
TPE
TRM
ICF
ICF
Media stream
Media stream
RSVP Signalling
Transport Domain
Call Control Signalling
QoS Signalling
Media Path

Diff Serv


QoS Signalling & Addressing - from Application Plane
TPE
TRM
Add Diff Serv Marker
Media stream
ICF
ICF
Media stream
Call Control Signalling
QoS Signalling
Media Path
Transport Domain
Policy Enforcement Element

Further Information

TIPHON Web site

http://www.etsi.fr/tiphon/

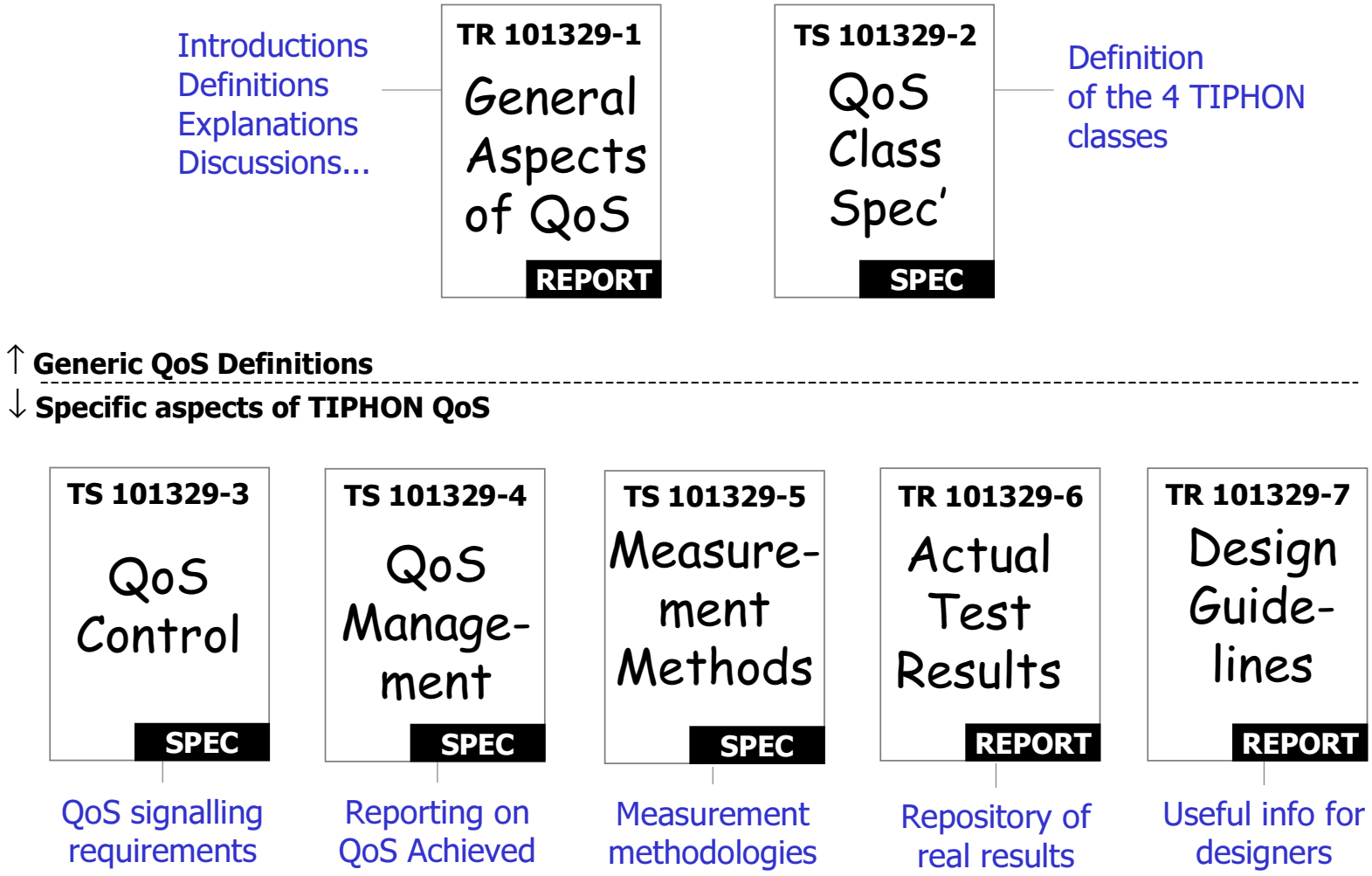
Access to Documentation

http://docbox.etsi.org/tech-org/tiphon/Document/tiphon/07-drafts/wg5/

TR 101 329 - Part 3

TIPHON; The signalling and control of end-to-end Quality of Service in TIPHON Systems

References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