Session-based End-to-end Policy Control for the 3GPP EPS

Richard Good

University of Cape Town
Department of Electrical Engineering

Neco Ventura

Fabricio Gouveia

Fraunhofer FOKUS

Thomas Magedanz

Overview

- Introduction
- Background
- Design Consideration
- Solution Architecture
- Testbed Implementation
- Performance Evaluation
- Conclusions and Future Work
- Q & A

Introduction

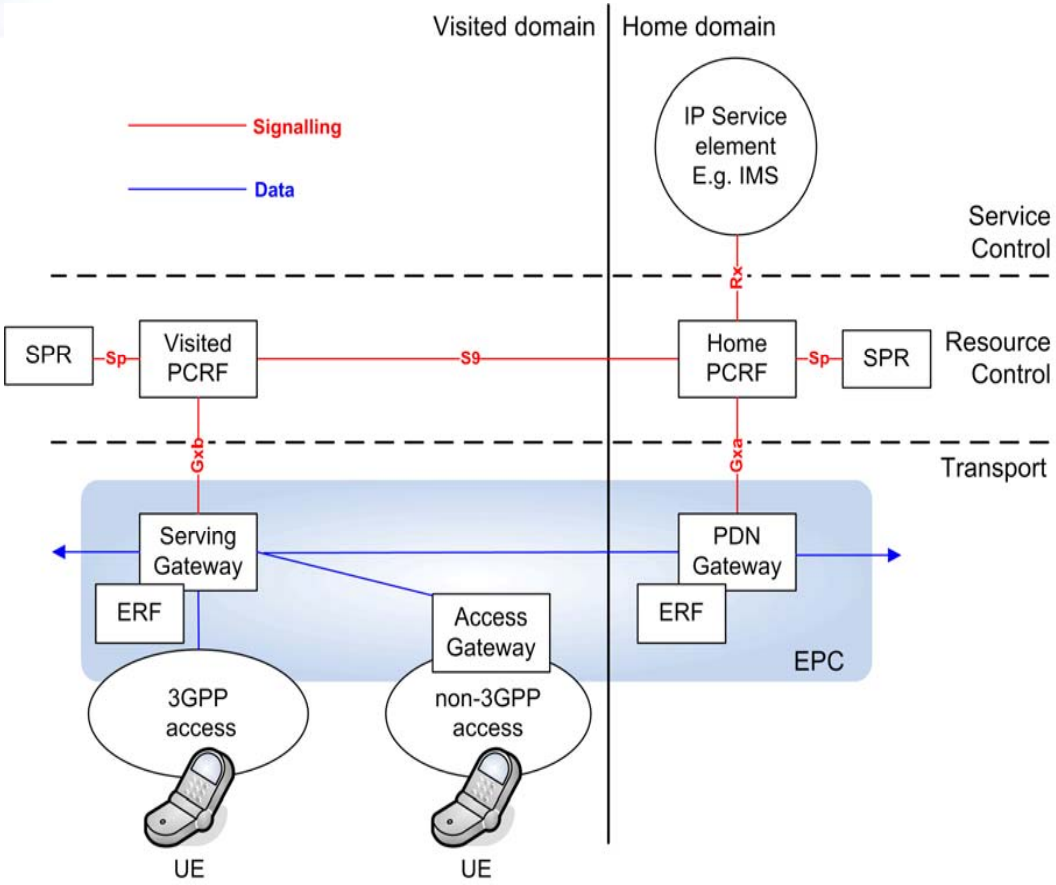
- 3GPP Release 8 feature freeze in December 2008
  - Important work items LTE access
  - Services Architecture Evolution core network
- EPC is simplified, flat all IP architecture that supports heterogeneity of 3GPP access networks and handles QoS, charging and mobility
- EPC supports evolved QoS concept based on policy based resource management from previous releases
- IMS seen as one of many IP service elements that interacts with EPC

IMS Deployment

- Global sales of IMS equipment increased 94% from 2007 to 2008
  - Driven by EPC deployment expected first quarter of 2010
  - Over 100 operators are investigating IMS, though less than 50% have deployments and carry live traffic[1]
- IMS as emerging technology faces many challenges
  - Deployment is on application by application basis
- Widespread proliferation of free Web 2.0 services
- Efficient management of resources through the PCC critical for IMS service differentiation
- PCC allows services plane to request resources from heterogeneous transport plane

1 Infonetics Research – IMS Equipment and Subscribers report
http://infonetics.com/pr/2009/4q08-ims-market-highlights.asp

3GPP PCC Rel. 8



- ***Push mode:*** QoS requirements passed over end-to-end path in application signalling.
- ***Pull mode:*** QoS requirements passed over the end-to-end path using path-coupled signalling, e.g. NSIS.

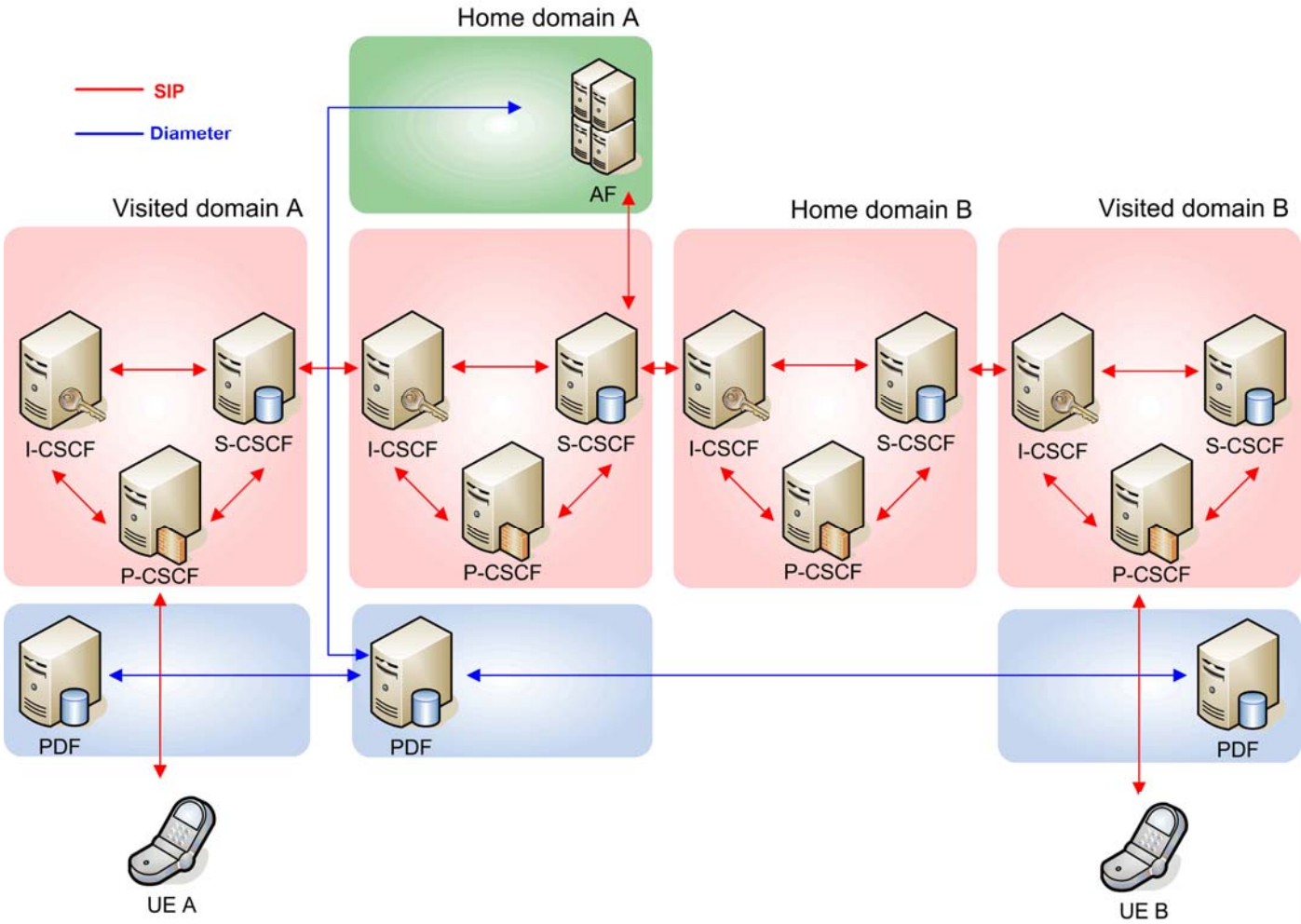
Motivation

- Pull mode path coupled approaches require transport layer overhaul.
- Push mode approaches have thus far no way of detecting end-to-end path – only reserve resources in originating and terminating domains.
- Push mode has distinct advantages:
  - Centralised policy control at the network
  - Reuse of autonomous existing resource management mechanisms
- Need to link signalling path with media – reserve resources in all traversed transport segments.

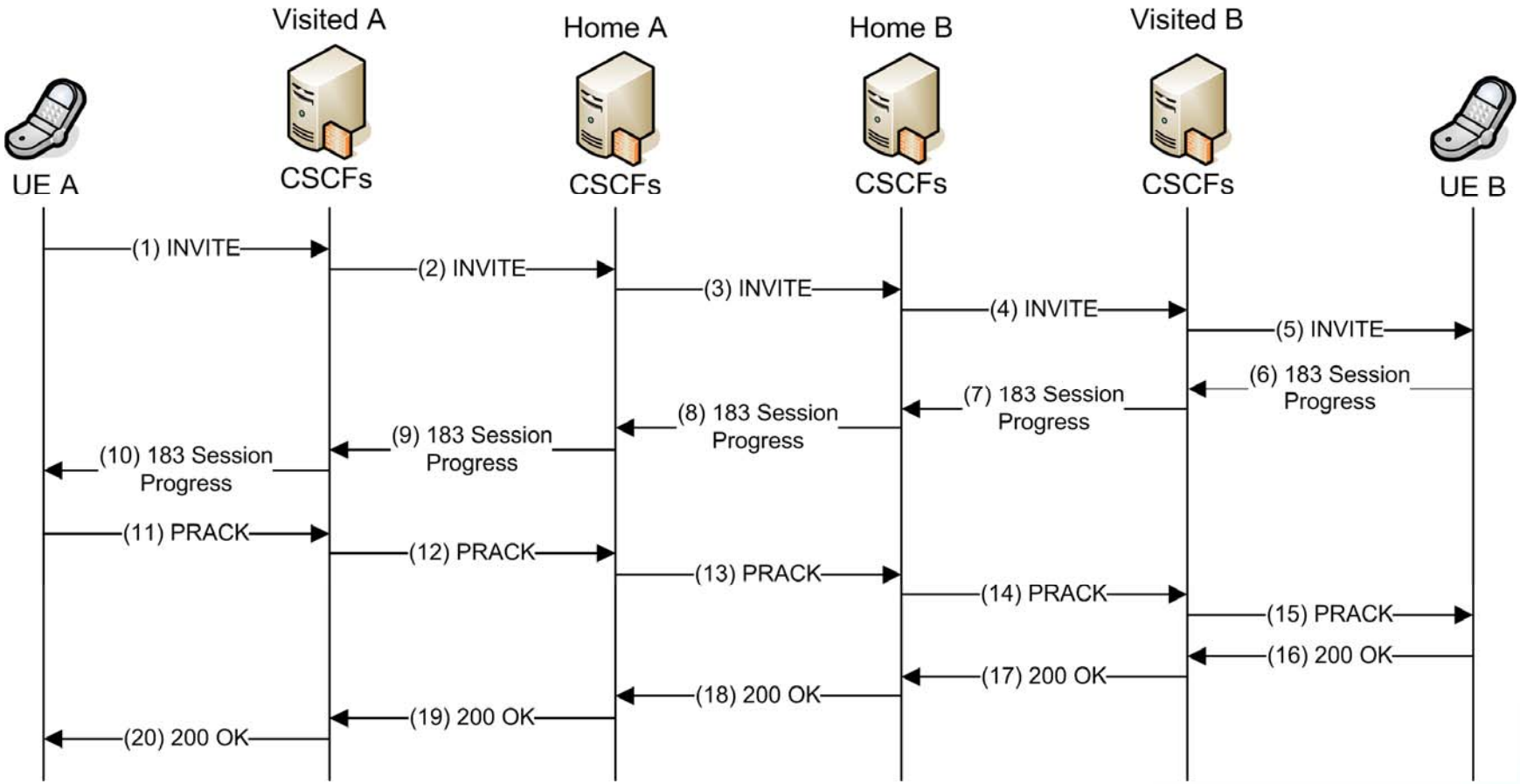
Design Considerations

- End-to-end QoS connectivity across administrative domains
- Push vs Pull mode operation
- Backward compatability
- Home routed access
- Standards compliance
- Negligent effect on end-user experience

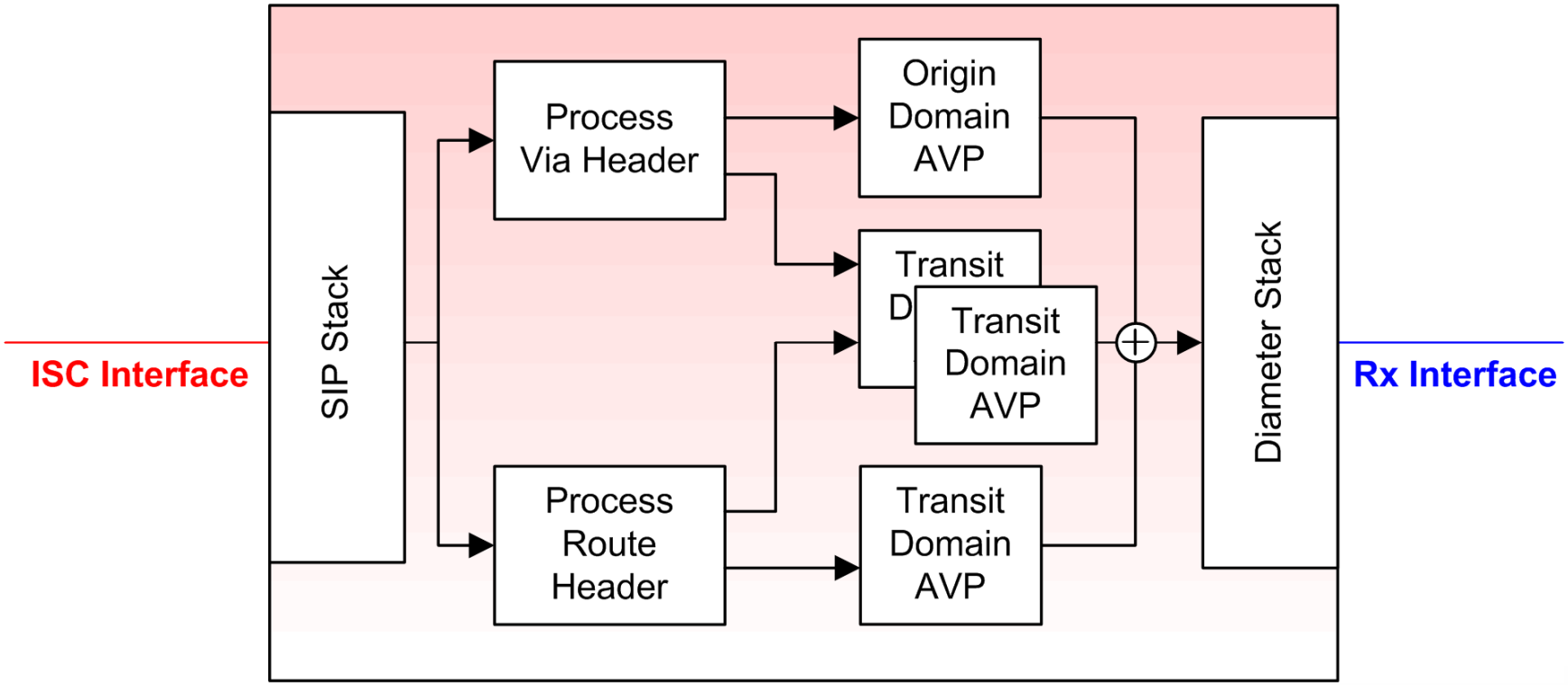
Solution Architecture



Signalling path discovery



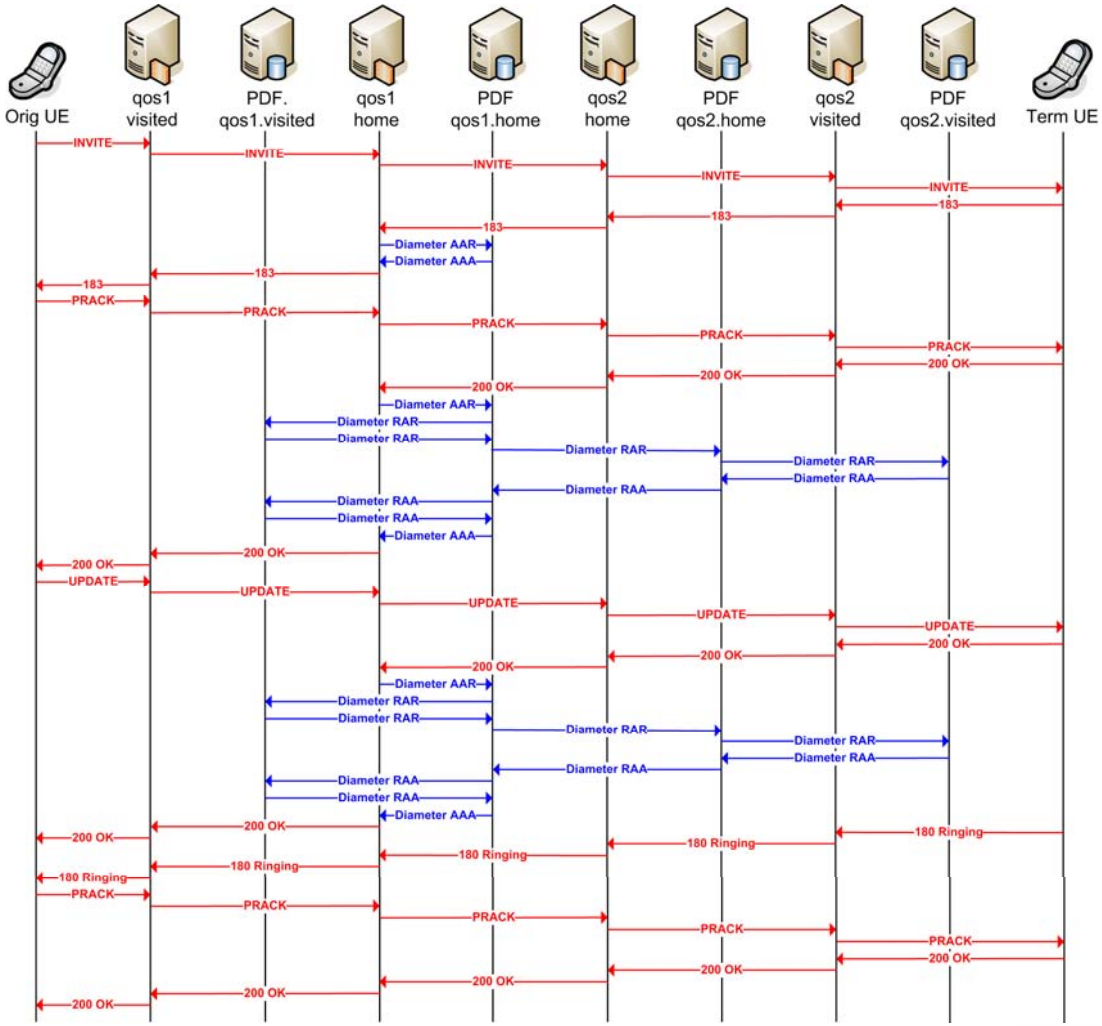
Extended AF


ISC Interface
SIP Stack
Process Via Header
Process Route Header
Origin Domain AVP
Transit D
Transit Domain AVP
Transit Domain AVP
Diameter Stack
Rx Interface

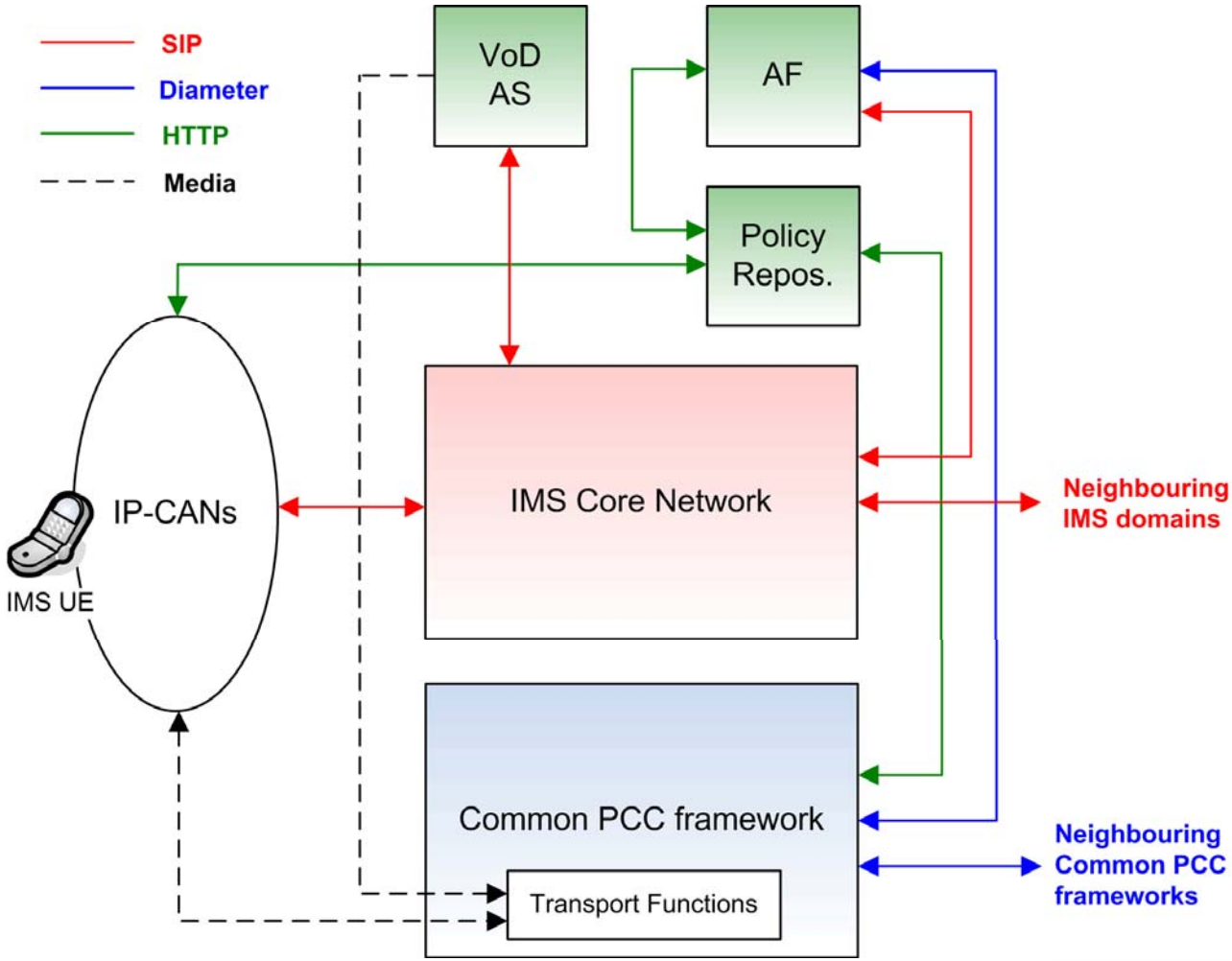
Media Path Discovery

1. Originating and terminating domains are the same
2. Originating and terminating domains are different, no transit domains
3. Originating and terminating domains are different, transit domains present
   - Request forwarded to PCRF in originating domain.
   - Each PCRF has address of neighbouring PCRFs and traverses signalling path in reverse until known PCRF is reached.
   - All subsequent domains are dropped and request forwarded to next domain.

Extended Interactions

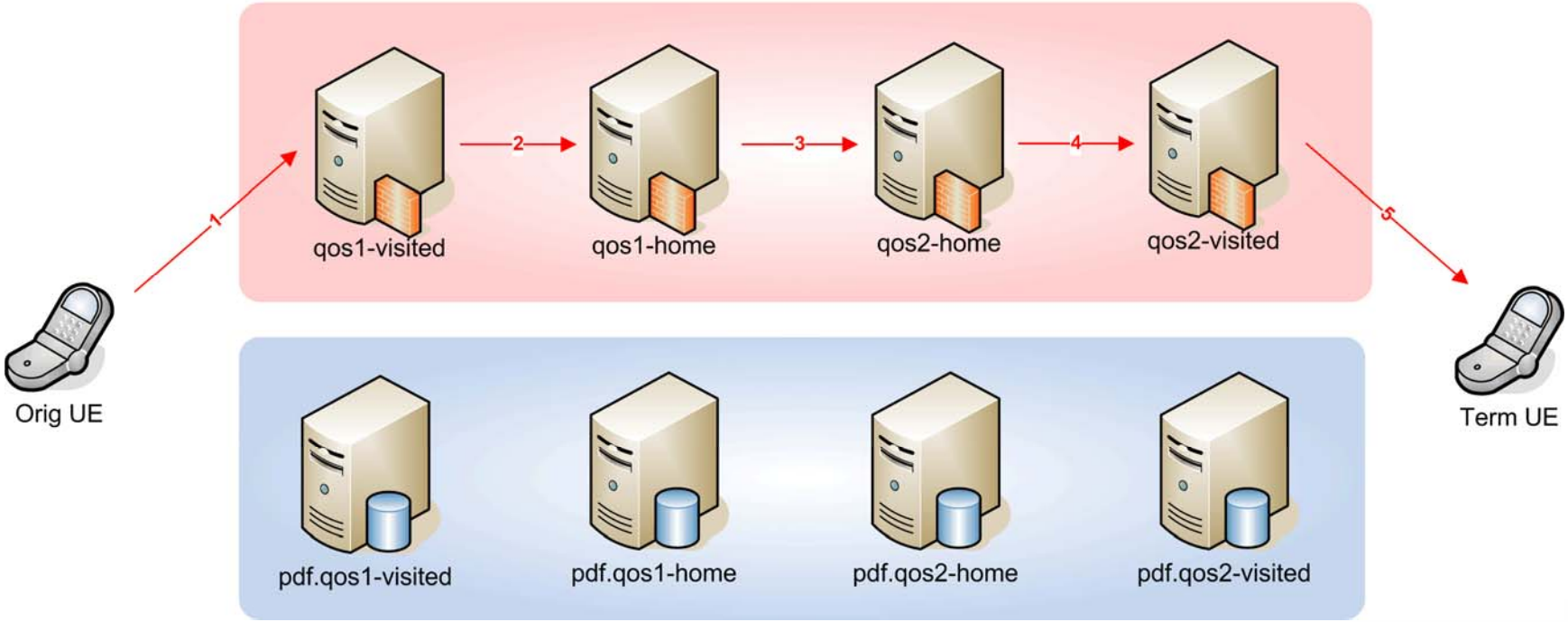


Testbed Implementation



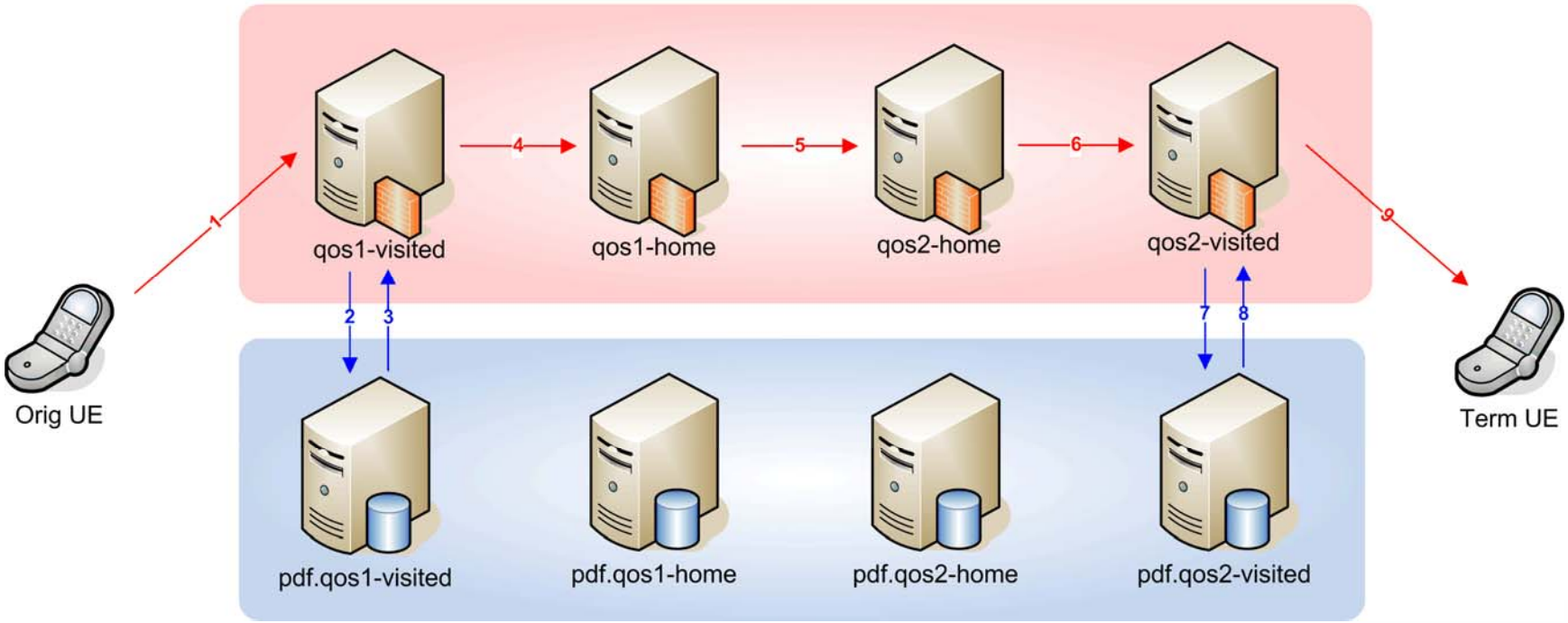
Testing Scenarios

Scenario 1: Reference Case



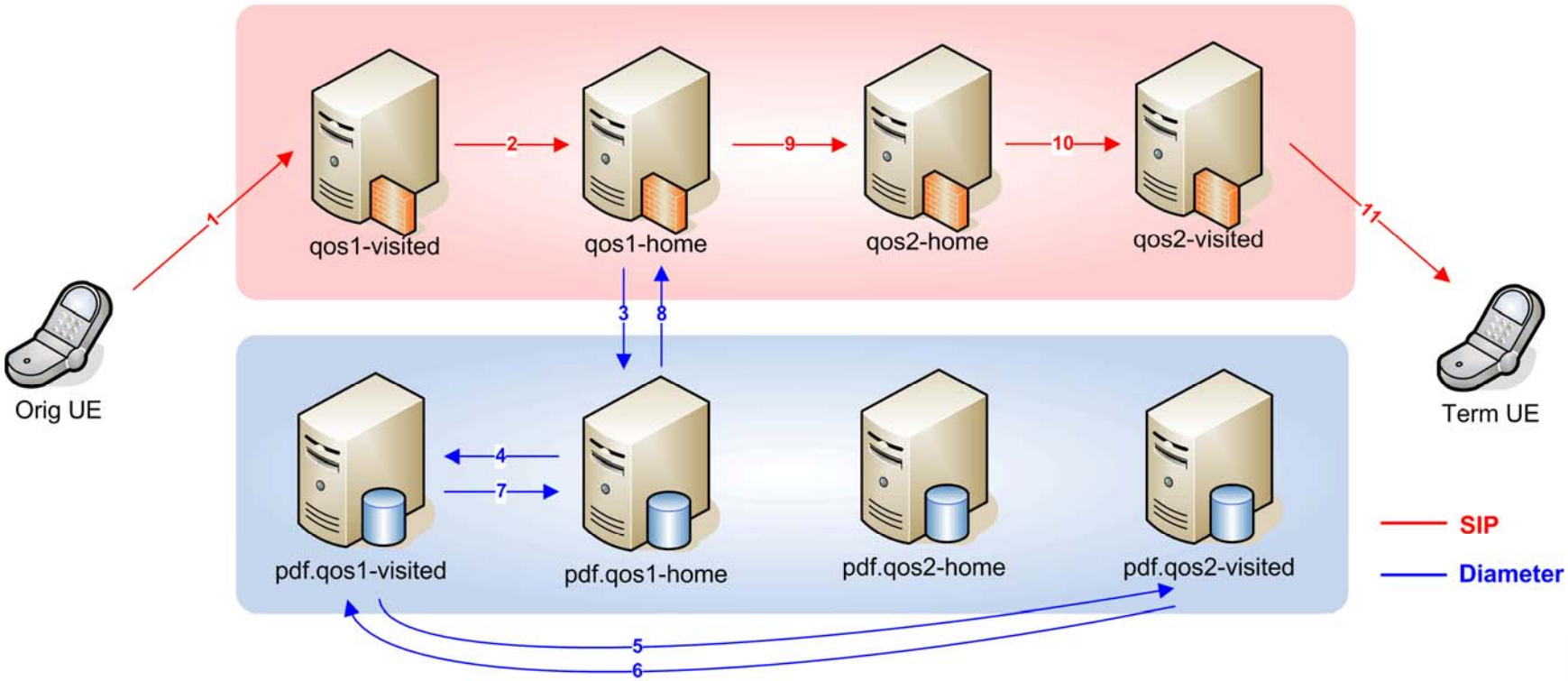
Testing Scenario (cont.)

Scenario 2: Application driven policy control in originating and terminating domains



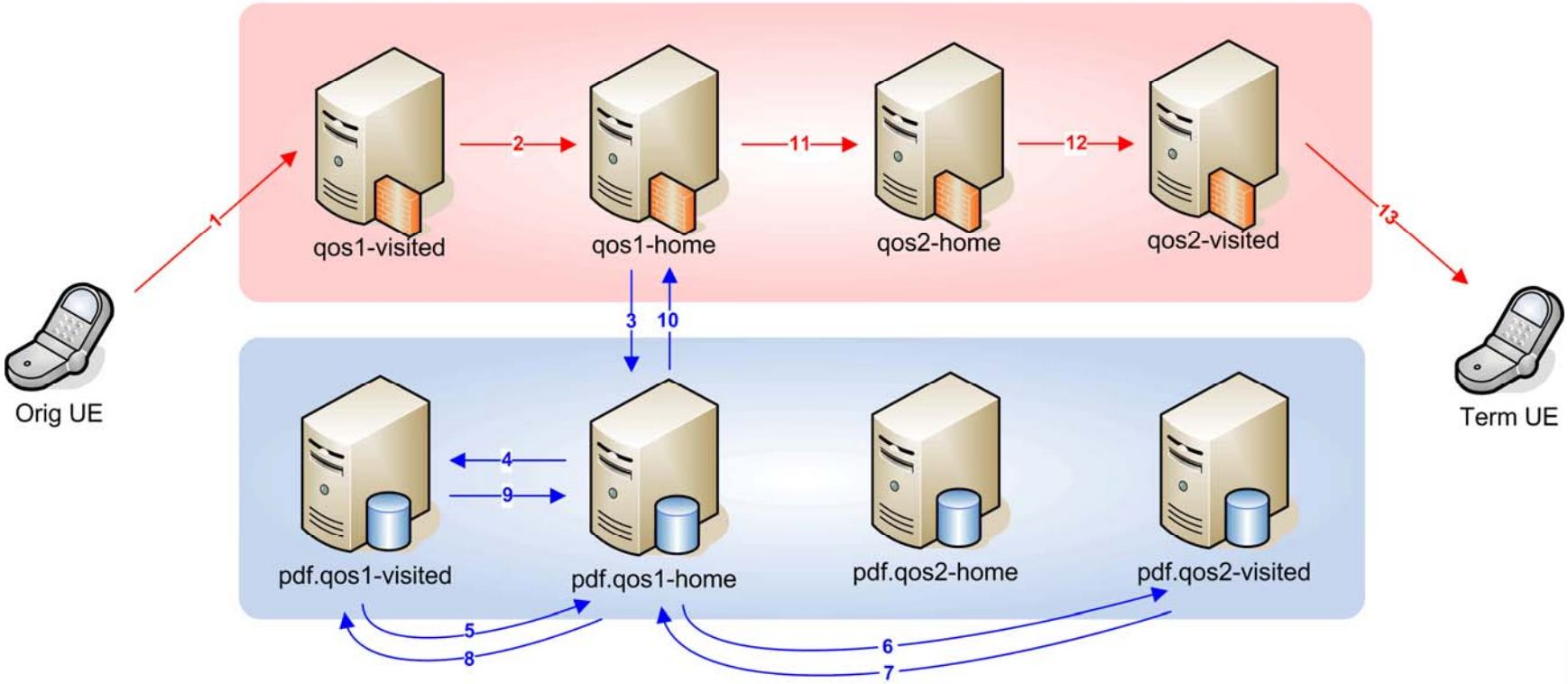
Testing Scenarios (cont.)

Scenario 3: Session end-to-end policy control architecture with resource authorisation in 2 domains



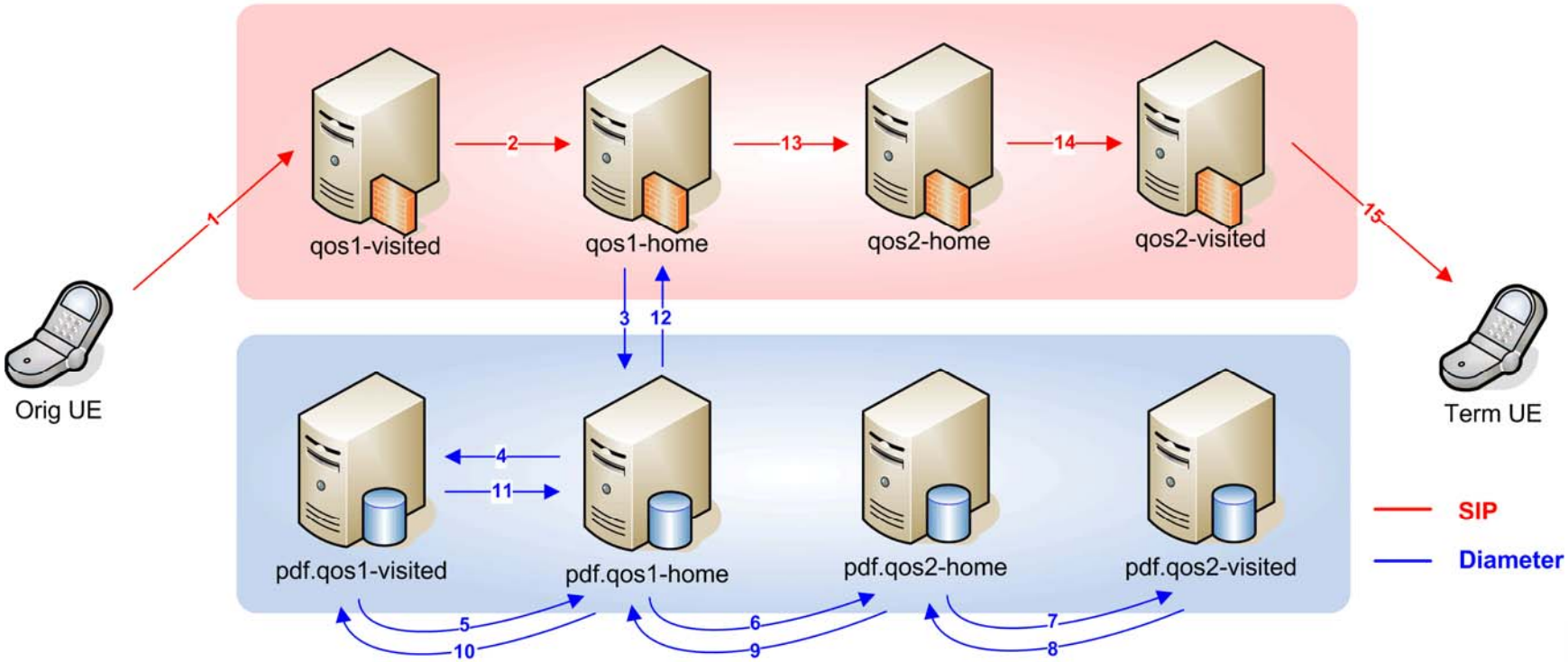
Testing Scenarios (cont.)

Scenario 4: Session end-to-end policy control architecture with resource authorisation in 3 domains



Testing Scenarios (cont.)

Scenario 5: Session end-to-end policy control architecture with resource authorisation in 4 domains



Session Setup Delay Results

LAN ACCESS					
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Mean (s)	1.288	1.366	1.480	1.505	1.508
Delay overhead (%)	-	**6.056**	**14.907**	**16.848**	**17.081**

HSDPA					
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Mean (s)	2.406	2.460	2.598	2.688	2.690
Delay overhead (%)	-	**2.244**	**7.980**	**11.721**	**11.804**

Traffic Overhead Results

ANY ACCESS					
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Total core traffic (bytes)	144985	163609	195027	201812	221209
Traffic overhead (%)	-	**57.034**	**87.189**	**93.702**	**112.319**

Discussion

- Sharp rise in scenario 3 is due to consecutive discovery of domains
- More complex media paths have limited effect on session setup delay
- While there is a cost in implementing end-to-end solution, cost does not rise linearly with number of domains on media path
- Total core traffic spread across 4 domains
- Under 50kB of core traffic added for additional domain on media path

Conclusions and Future Work

- End to end session based policy control for EPC framework
  - Uses pull mode operation
  - Operates at service control and resource control planes hence allows reuse of transport technology
  - Allows autonomous resource management in each domain
- End to end QoS possible without overhaul of transport layer, and minimum effect on end-user experience
- Future work items
  - More realistic evaluations – load testing
  - Hybrid approaches involved push and pull mode
  - Effect on specific service invocation

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Questions and Comments

Richard Good

rgood@crg.ee.uct.ac.za