ITU-T Kaleidoscope Conference Innovations in NGN

Analysis and Optimization of Resource Control Schemes in NGN

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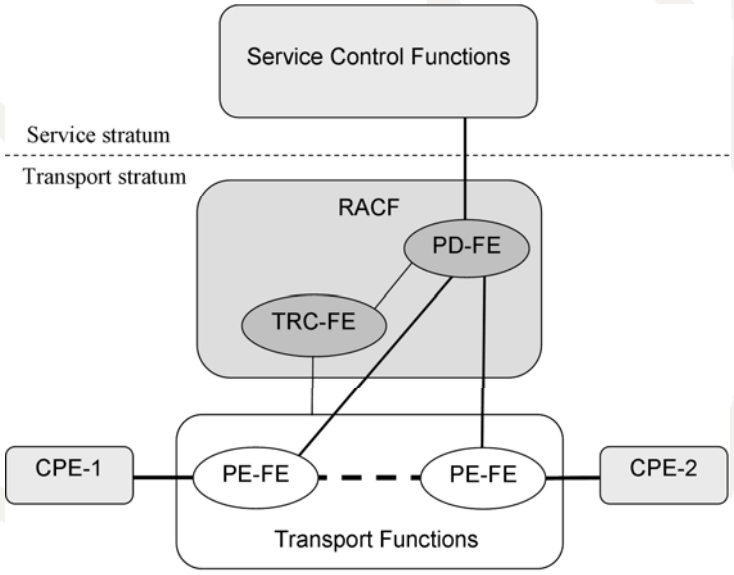
Topics

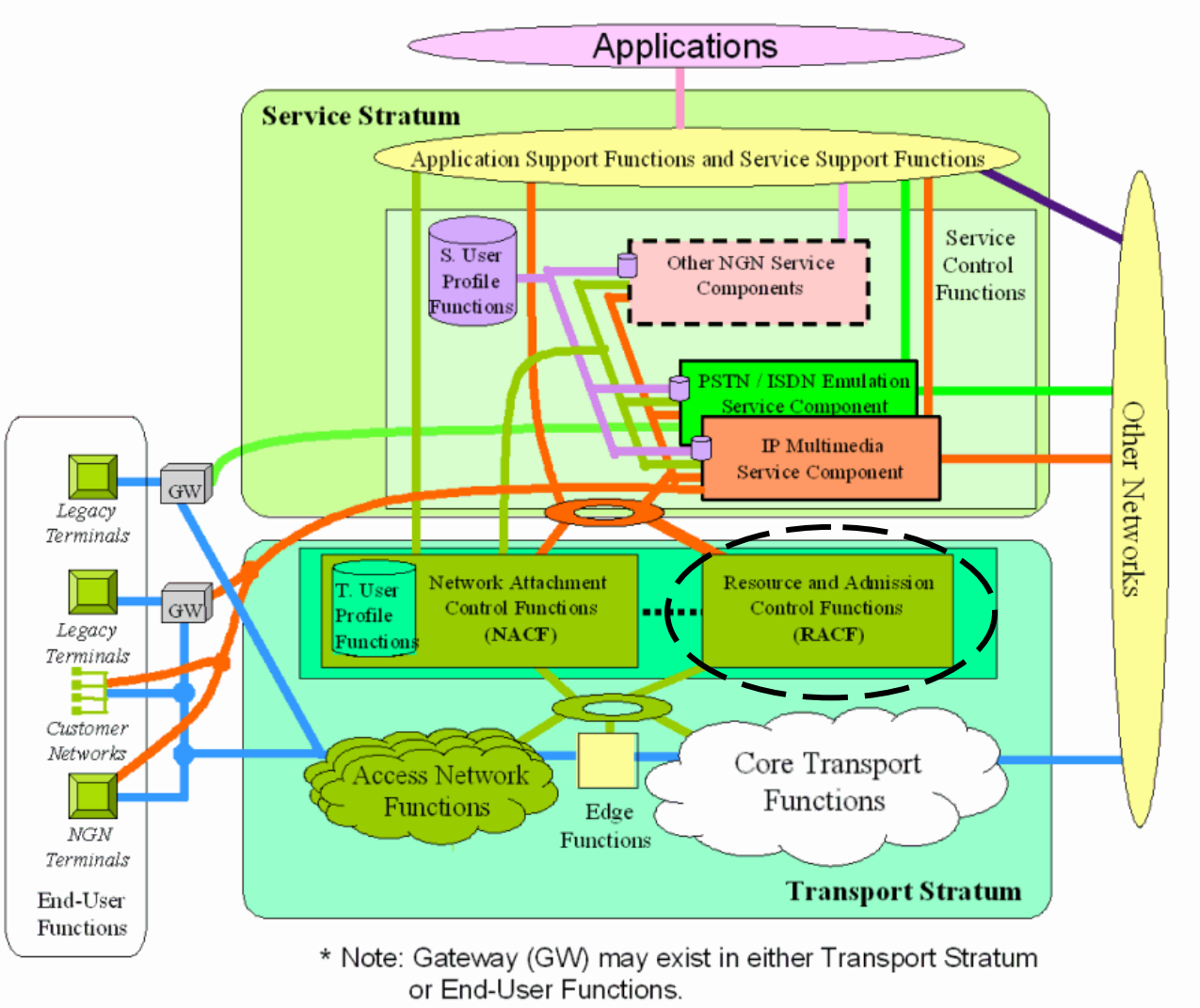
- Introduction to RACF
- Definitions
- Call flows
- Resource utilization
- Conclusion

RACF in NGN

- RACF consists of two resource and admission control functional entities
  - PD-FE (Policy Decision Functional Entity)
  - TRC-FE (Transport Resource Control Functional Entity)



RACF in NGN


Applications
Service Stratum
Application Support Functions and Service Support Functions
S. User Profile Functions
Other NGN Service Components
Service Control Functions
PSTN / ISDN Emulation Service Component
IP Multimedia Service Component
Other Networks
GW
Legacy Terminals
GW
Legacy Terminals
Customer Networks
NGN Terminals
End-User Functions
T. User Profile Functions
Network Attachment Control Functions (NACF)
Resource and Admission Control Functions (RACF)
Access Network Functions
Edge Functions
Core Transport Functions
Transport Stratum
* Note: Gateway (GW) may exist in either Transport Stratum or End-User Functions.

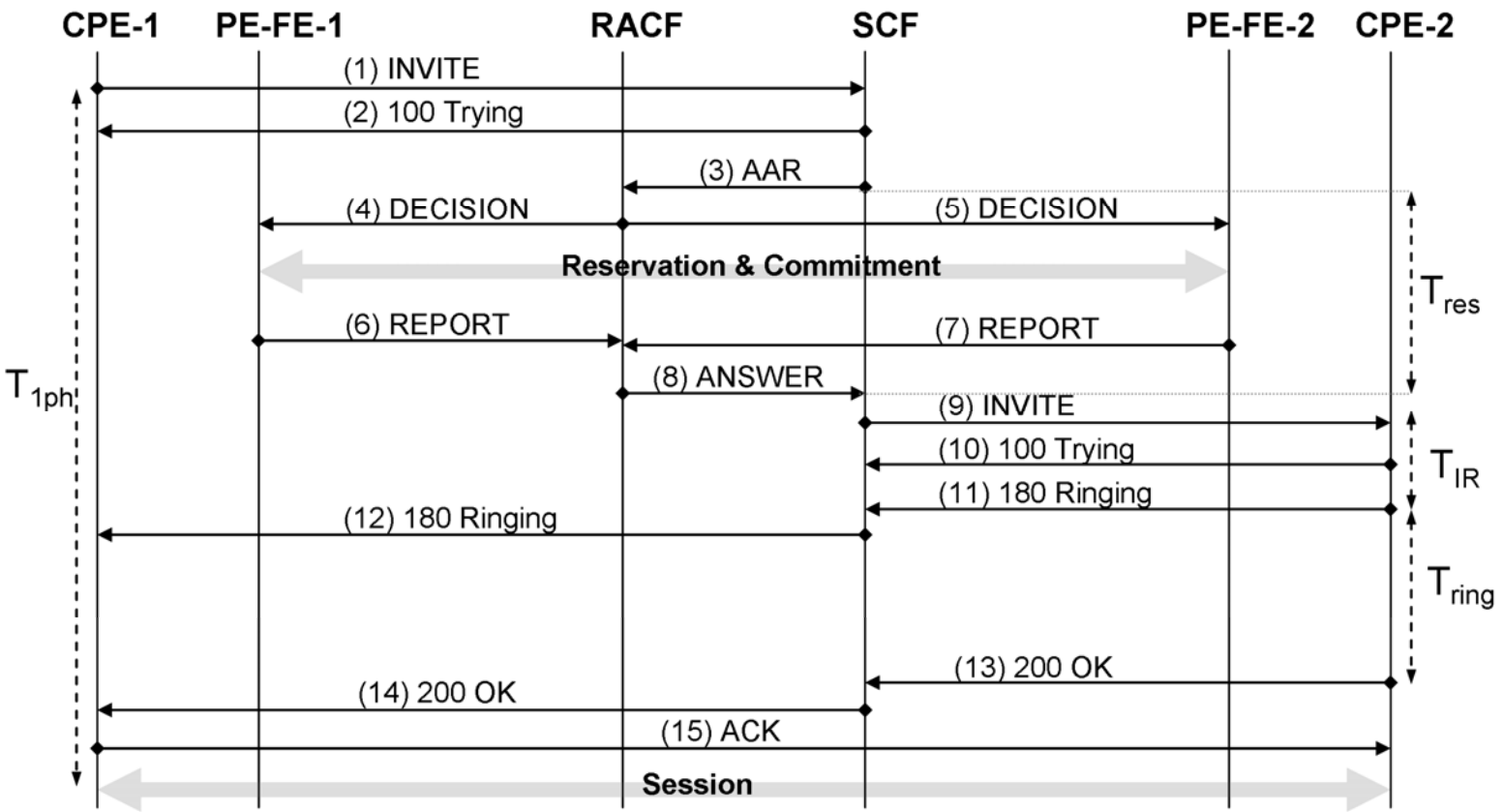
States

- **Authorization**: The QoS resource is authorized based on policy rules.
- **Reservation**: The QoS resource is reserved based on the authorized resource and resource availability.
- **Commitment**: The QoS resource is committed for the requested media flows when the gate is opened and other admission decisions are enforced in the transport functions.

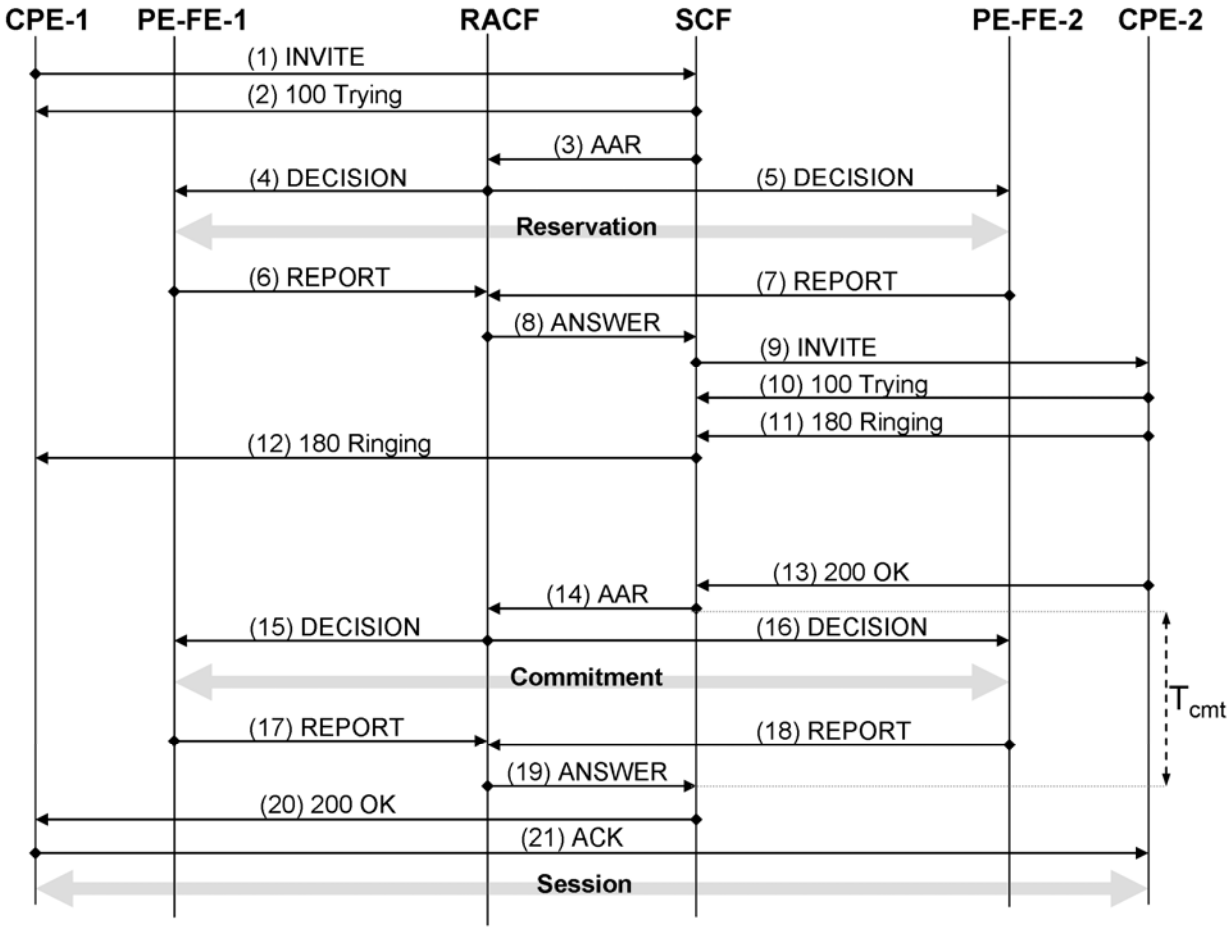
Schemes

- **Single-phase scheme:**
  - Authorization, reservation and commitment in one step.
- **Two-phase scheme:**
  - Authorization and reservation in one step and commitment in another step.
  - Authorization in one step and commitment in another step.
- **Three-phase scheme:**
  - Authorization, reservation and commitment are performed in three steps sequentially.

Single-phase call flow



Two-phase call flow



Differences between two call flows

- Stage 3:
  - Resource reservation is requested by SCF from RACF.
  - According to Q.3301 this request should have the *Resource-Reservation-Mode=1*
  - It means only authorization and reservation steps should be performed in a single step.
- Stage 14:
  - Resource commitment is requested by SCF from RACF.
  - According to Q.3301 this request should have the *Resource-Reservation-Mode=3*
  - It means only commitment step should be performed. This request will be sent when the message *200 OK* is received from CPE-2 to SCF (Off-hook state).

Call Setup Delay (CSD)

$$CSD_{1ph} = T_{1ph} - (T_{IR} + T_{ring})$$

$$CSD_{2ph} = CSD_{1ph} + T_{cmt}$$

T_{1ph}: Duration between sending the *INVITE* request and receiving the *200 OK* message by CPE-1

T_{IR}: Duration between receiving the *INVITE* request and sending *180 Ringing* message by CPE-2

T_{ring}: The average time required for answering to the incoming call

T_{cmt}: The required signaling time for committing the reserved resources

Resource utilization

- The time during which the resources are in use

$$T_{use-1ph} = \frac{T_{res}}{2} + T_{IR} + T_{ring} + T_{call}$$

$$T_{use-2ph} = \frac{T_{cmt}}{2} + T_{call}$$

$\mathbf{T_{call}}$: The average call holding time

$\mathbf{T_{res}}$: The signaling time for resource reservation

$\mathbf{T_{use\text{-}1ph}}$: The time during which the resources are in use in the 1-phase scheme

$\mathbf{T_{use\text{-}2ph}}$: The time during which the resources are in use in the 2-phase scheme

Resource utilization

- The ratio of in-use time of 2-phase to 1-phase

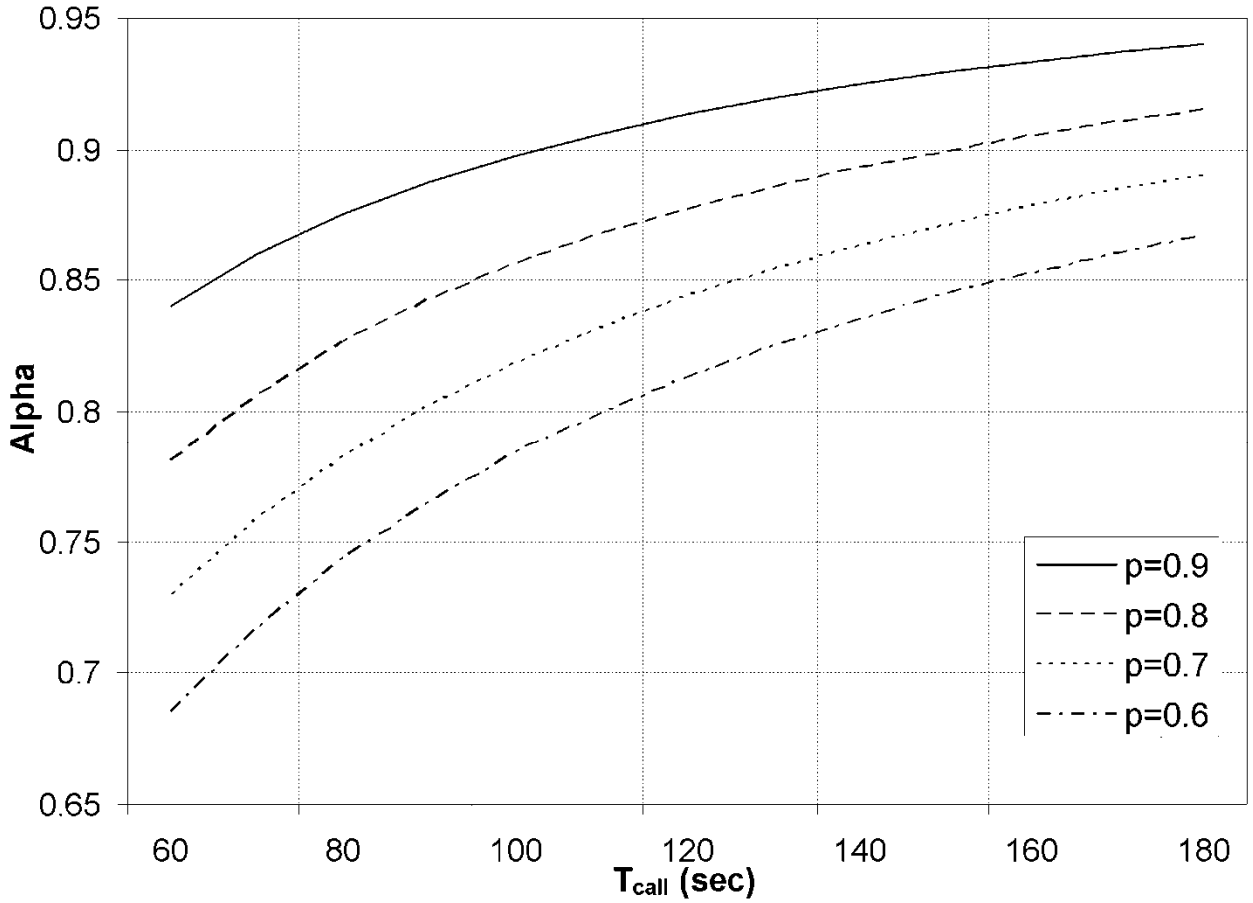
$$\alpha = \frac{T_{cmt}/2 + T_{call}}{T_{res}/2 + T_{IR} + T_{MTA}.p + T_{RTL}.(1-p) + T_{call}}$$

$\mathbf{T_{MTA}}$: The mean time to answer

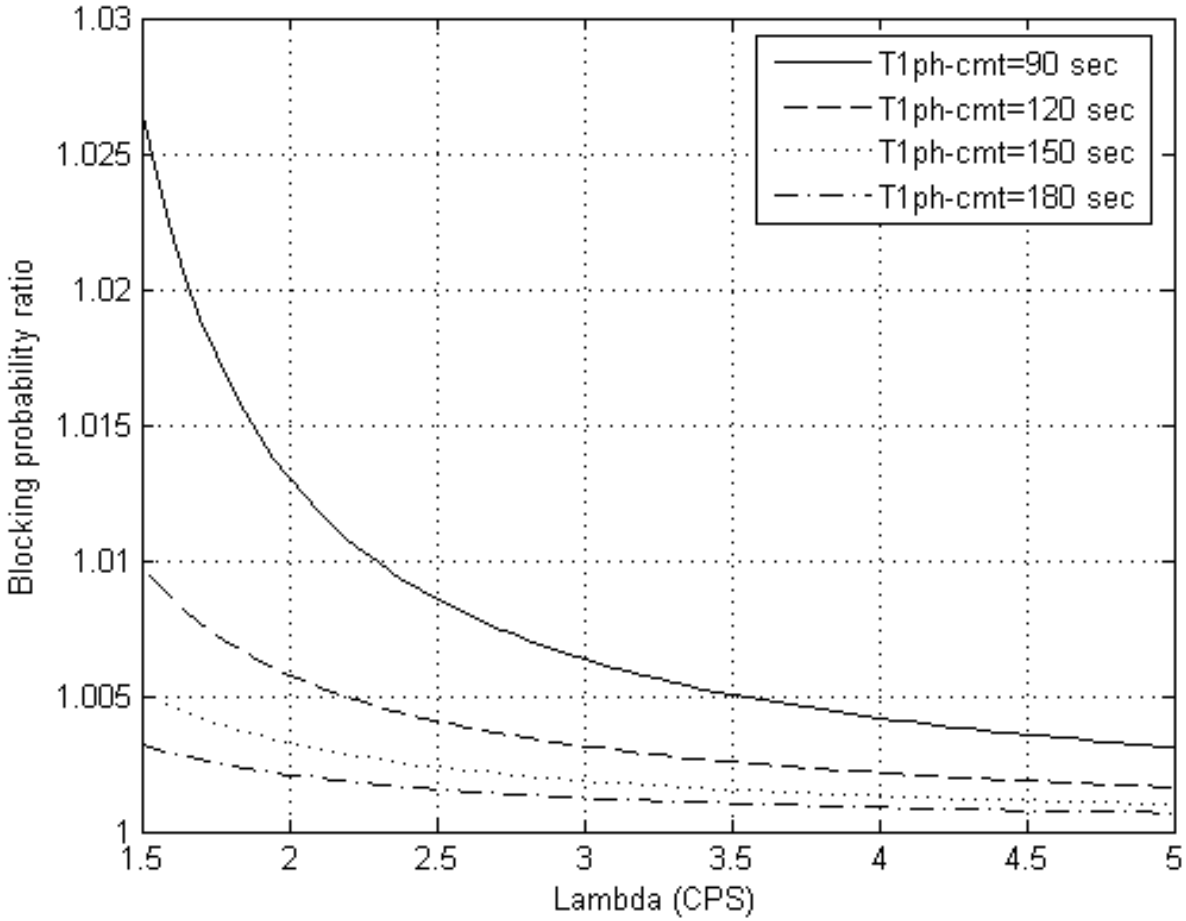
$\mathbf{T_{RTL}}$: The ring time limit

$\boldsymbol{p}$: The probability of call answering by the called party (≤1)

Resource Utilization Ratio



Blocking Probability Ratio



Conclusions

- **Dynamic policy**
  - Switching between 1-phase and 2-phase dynamically in RACF.
- **RACF and SCF responsibilities**
  - The resource control scheme selection should be the RACF's responsibility.
- **Protocol**
  - Modification to some protocols such as DIAMETER.

Thank you …