Modeling Handover Latency in PMIPv6-based Protocols with Timed Petri Nets

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DMM Special Track

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Handover Latency Modeling

• Time when the communication between nodes is interrupted because of the data path switch

• Mathematical equations
  – McNair, Akyildiz, and Bender
  – Hussain, Bakar, and Salleh
  – Makaya and Pierre

\[
T = M + (T_w + M) \times \frac{q}{1 - q},
\]

\[
T_{RS} = \frac{1 + P_f}{1 - P_f} \left( \frac{M_{RS}}{B_{wl}} + T_{wl} \right)
\]

\[
T_{PMIPv6}^{LU} = n_h \left( \frac{M_{PBU}}{B_{wd}} + T_{wd} \right)
\]

\[
T_{x-y} = \frac{1 + q}{1 - q} \left( \frac{M_{size}}{B_{wl}} + L_{wl} \right) + H_{x-y} \left( \frac{M_{size}}{B_w} + L_w + T_q \right)
\]
Timed Petri Nets

Places
Timed Transitions
Tokens
Arcs
PMIPv6 Handover
FPMIPv6 Handover (pred.)

L2 trigger

MN
PMAG
LMA
NMAG

Rtr Sol

HI

HACK

TUNNEL

RA

PBU
PBA

TUNNEL

P3

1

P4

1

T_L2Trigger T_TxRtrSol

P5

1

T_TxHI

P6

1

T_TxHack

P7

1

T_TxRA

1

TxPBU

1

TxPBA
FPMIPv6 Handover (react.)

- MN
- PMAG
- LMA
- NMAG

L2 trigger
Rtr Sol

HI
HACK

TUNNEL

RA

PBU
PBA

TUNNEL

P3 P4
T_L2Trigger T_TxRtrSol

T_MAStart

P5 1

T_TxHI

1 1

T_TxHack

P6

P7

1

1

TxPBU

1

TxPBA

1

T_TxRA
Conclusions and Future Work

- Timed Petri Nets as a tool for modeling PMIPv6-based protocols
  - Resource consumption
  - Parallelism
  - Synchronization
  - Time elapsing
- Future work
  - Characterization of signaling delays
  - Stochastic Petri Nets
  - Express buffering and data flow
  - CI-PMIPv6 scalability
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