Performance Evaluation of TCP Throughput on Wireless Cellular Networks

Osaka University

Masahiro Miyoshi, Masashi Sugano, Masayuki Murata

mmiyoshi@d3.dion.ne.jp

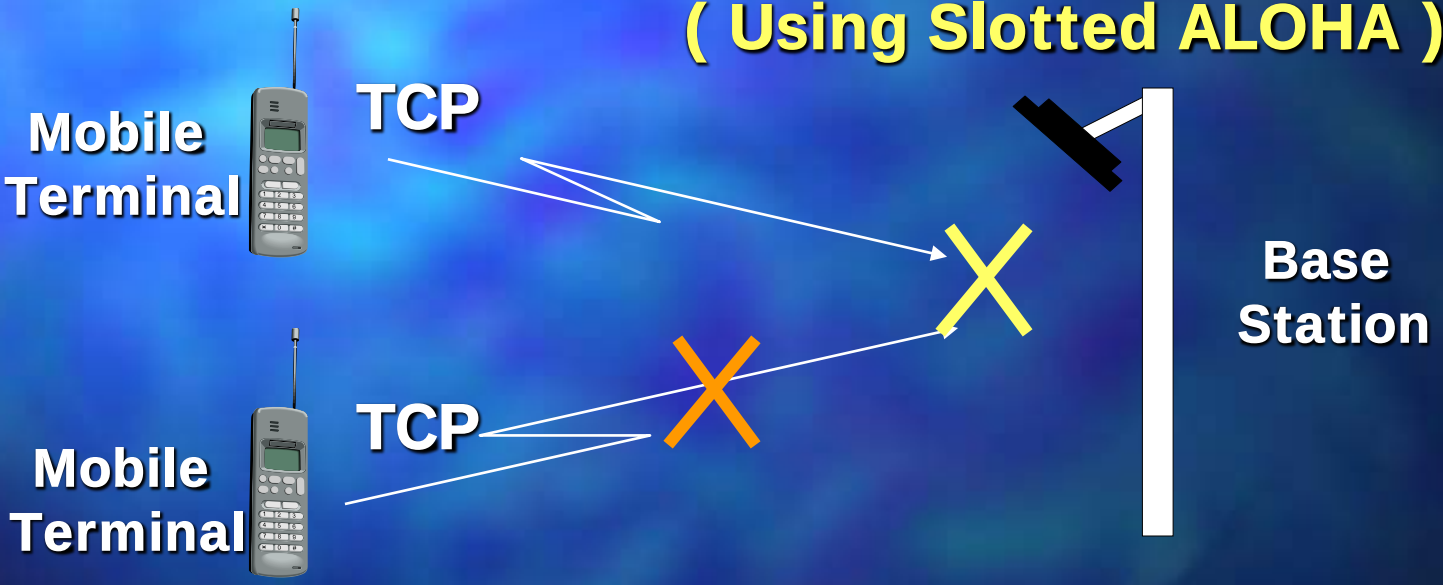
Contents

- Backgrounds
- Objectives
- Network model
- Analysis method
- Evaluation
- Conclusion

Backgrounds

IMT-2000 Network in JAPAN

Collision detection
(Using Slotted ALOHA)



Transmission error recovery
(Using FEC,ARQ)

Past researches

Evaluate TCP performance
on Wireless channels

- Influence of transmission error
- Influence of handoff

No consideration influence of lower layer protocols above researches

Objectives

Evaluate TCP performance

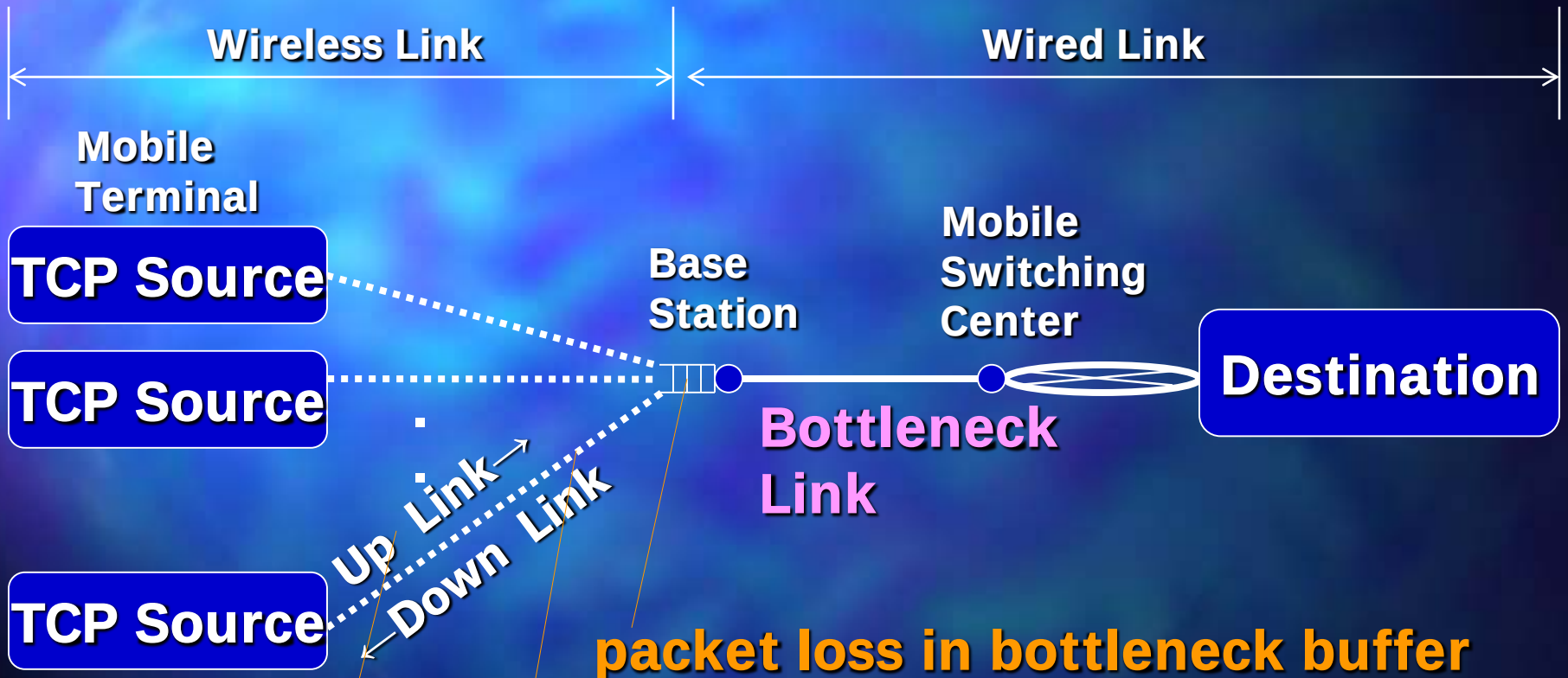
- By considering collision detect protocol

  Slotted ALOHA

- By error correct protocol

  ARQ, FEC

Network Model



Network Model

Our View

about packet loss on TCP

- packet loss in bottleneck buffer
- packet loss by transmission error

→ packet loss on TCP layer

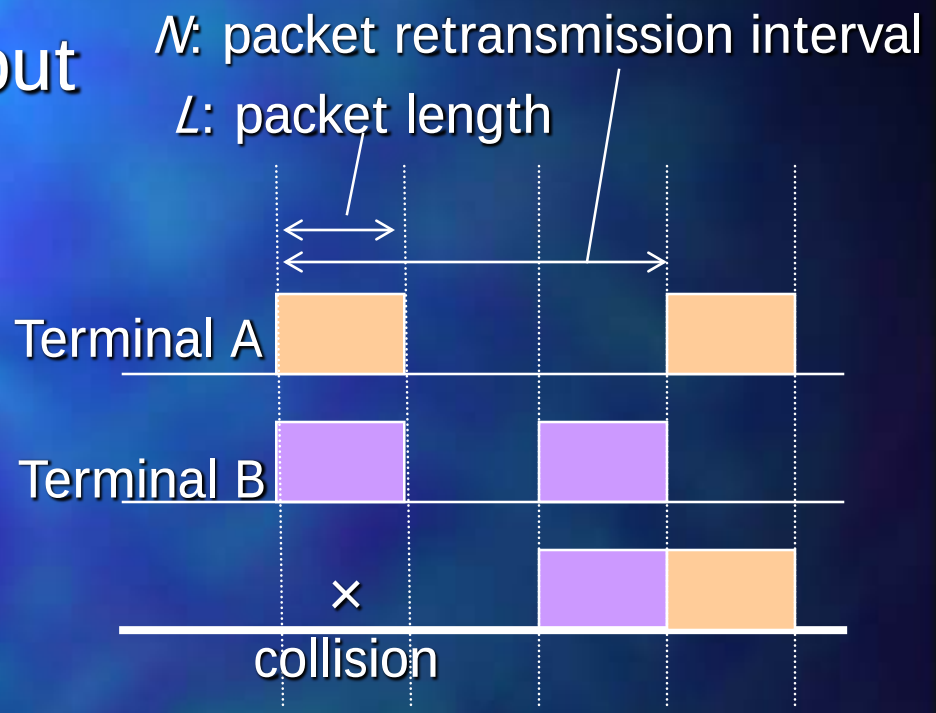
- packet loss by collision
(using Stop and Wait retransmission)

→ delay on TCP layer

Analysis Method

- Slotted ALOHA throughput

$$S_{ALOHA} = G\exp(-G)$$



- Slotted ALOHA delay

$$D_{ALOHA} = \sum_{i=0}^{\infty}(i+1)NL(1-S_{ALOHA})^{i}S_{ALOHA}$$

Analysis Method

- TCP throughput

Packet loss rate ← Parameter

Round trip time ← D_{ALOHA}

$$S_{TCP} = \frac{1}{RTT\sqrt{\frac{2bp}{3}} + To\min\left(1, 3\sqrt{\frac{3bp}{8}}\right) p\left(1 + 32p^2\right)}$$

Time out time ← D_{ALOHA}

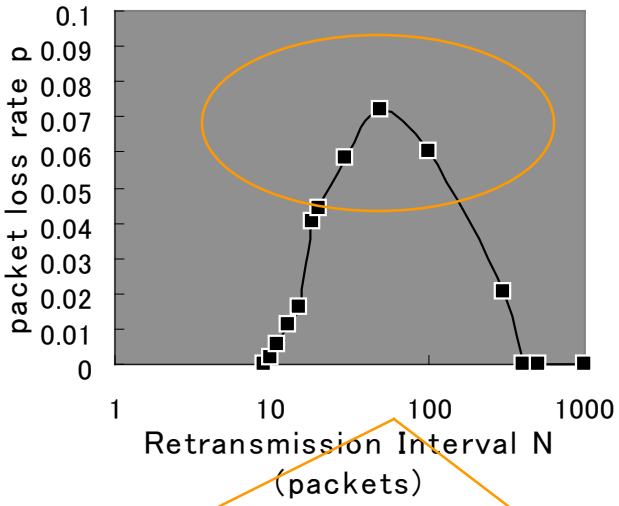
Evaluatio

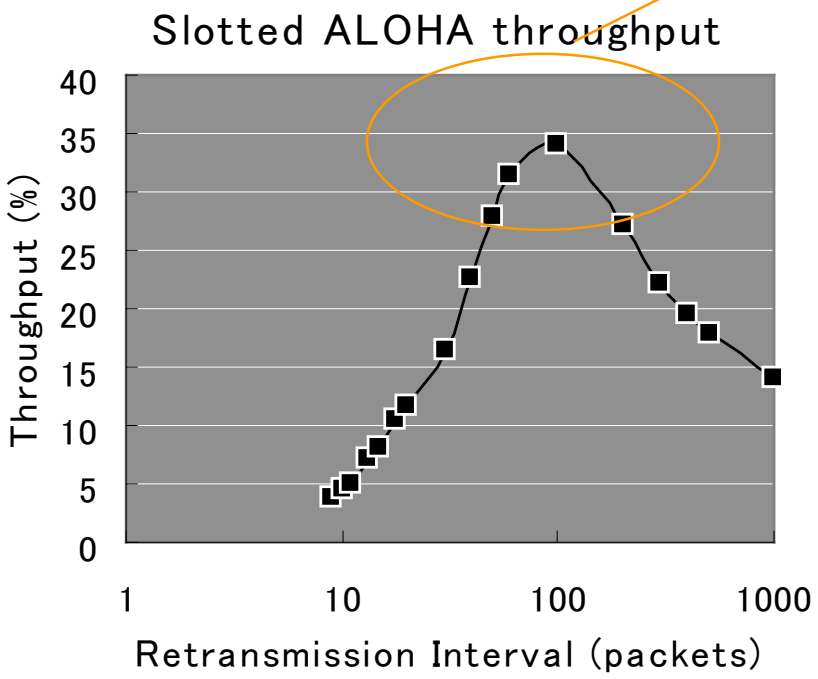
Improving thro
necessarily lea

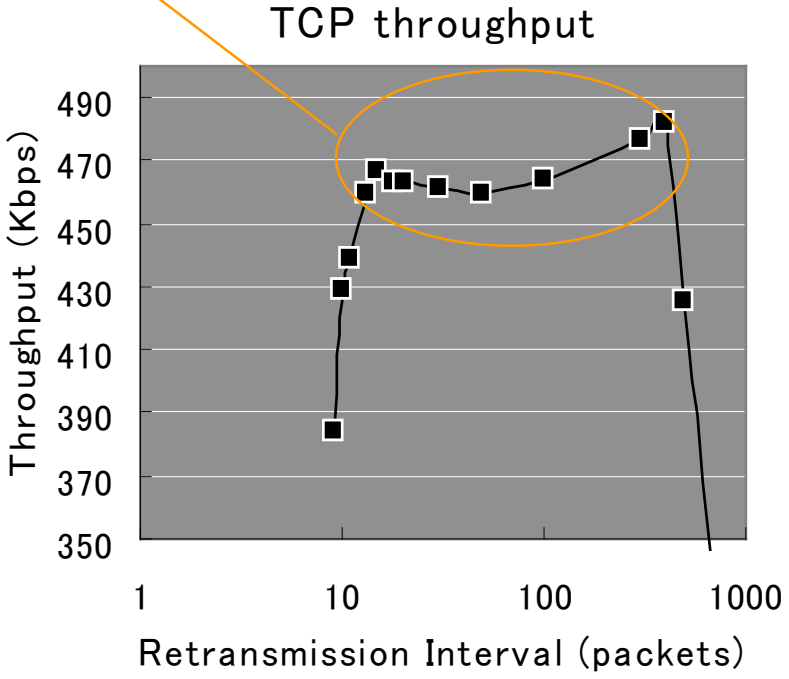
eter sets

reless link : 2Mbps
red link : 125Kbps
mobile Terminal: 30nodes
e: 100Bytes

ALOHA does not
ut improvement





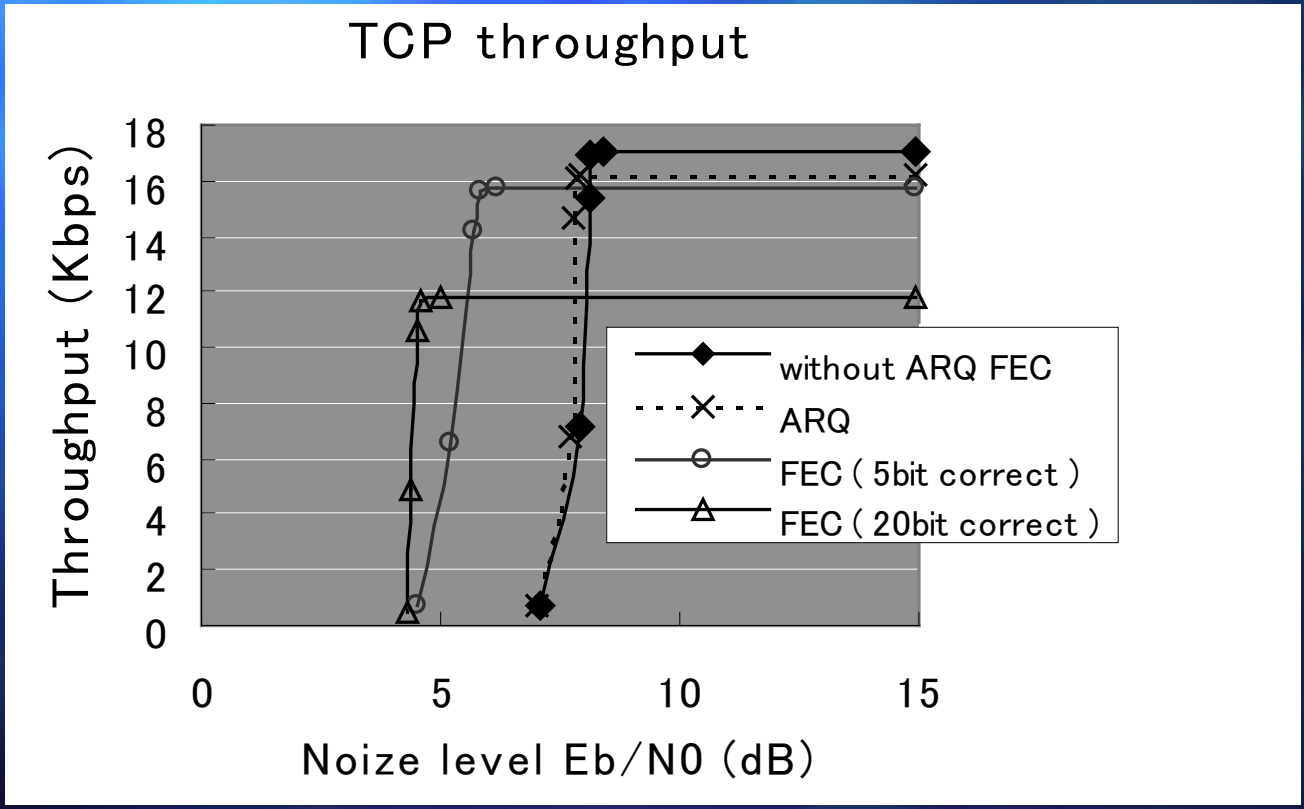


Evaluation

Parameter sets

Bandwidth of wireless link : 2Mbps
Bandwidth of wired link : 125Kbps
The number of mobile Terminal: 5nodes
TCPsegment size: 100Bytes
ARQ:Go back N, retransmission times 1
FEC(5bit correct):Reed Solomon(127,117)
FEC(20bit correct):Reed Solomon(127,87)

The use of FEC is effective to prevent TCP throughput degradation



Conclusion

We have shown TCP performance considering influence of lower layer protocols

- Improving throughput at the Slotted ALOHA does not necessarily lead to the TCP throughput improvement
- The use of FEC is effective to prevent TCP throughput degradation