GBT
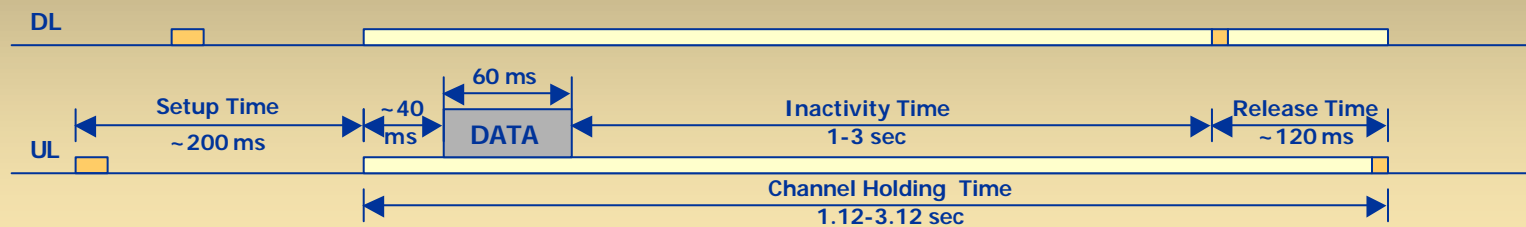GOLDEN BRIDGE TECHNOLOGY

Presentation on
RP-010-221: Impact of Packet Mode
Capacity Gain on 3G deployment of
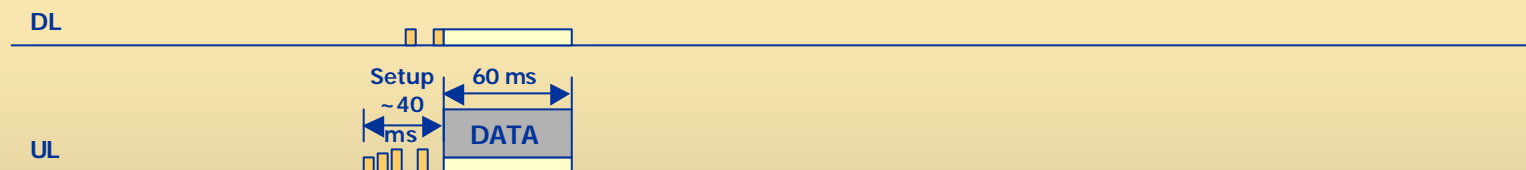# *non real time services*

GBT, ADL, SBC Technology Resources
RAN #11: Agenda item 6.11

www.gbtwireless.com

DCH vs. CPCH

DCH Method

DL

UL

60 ms

Setup Time
~200 ms

~40 ms

DATA

Inactivity Time
1-3 sec

Release Time
~120 ms

Channel Holding Time
1.12-3.12 sec
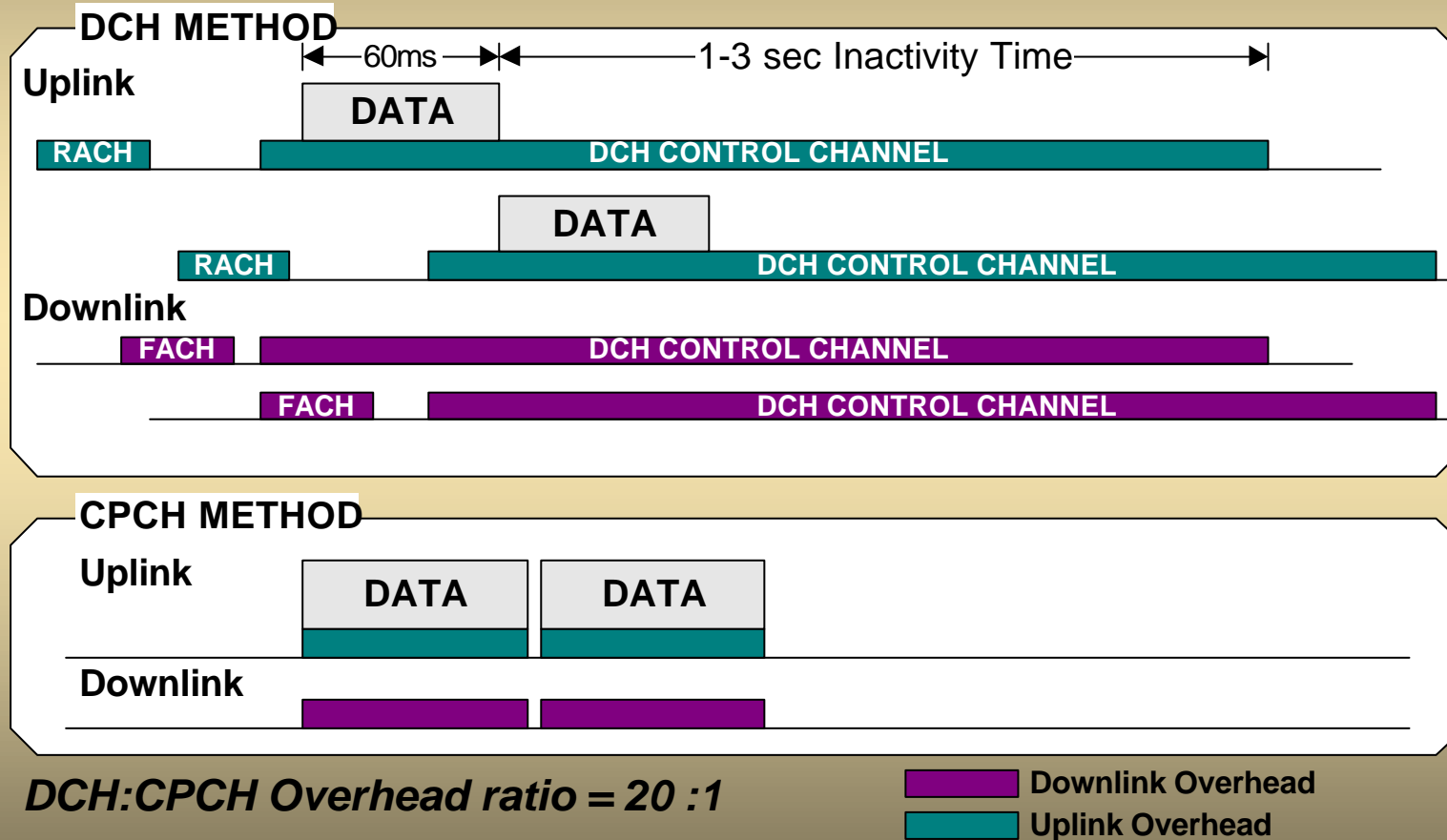
CPCH Method

DL

UL

Setup
~40 ms

60 ms

DATA

CPCH Offers:

– Shorter Set-up Time

– No Inactivity Time

– No Release Time

Uplink Comparison

Use of DCH Uplink IMPAIRS Downlink Capacity

DCH METHOD

Uplink

|← 60ms →|← 1-3 sec Inactivity Time →|

DATA

RACH | DCH CONTROL CHANNEL

DATA

RACH | DCH CONTROL CHANNEL

Downlink

FACH | DCH CONTROL CHANNEL

FACH | DCH CONTROL CHANNEL

CPCH METHOD

Uplink

DATA | DATA

Downlink

DCH:CPCH Overhead ratio = 20 :1

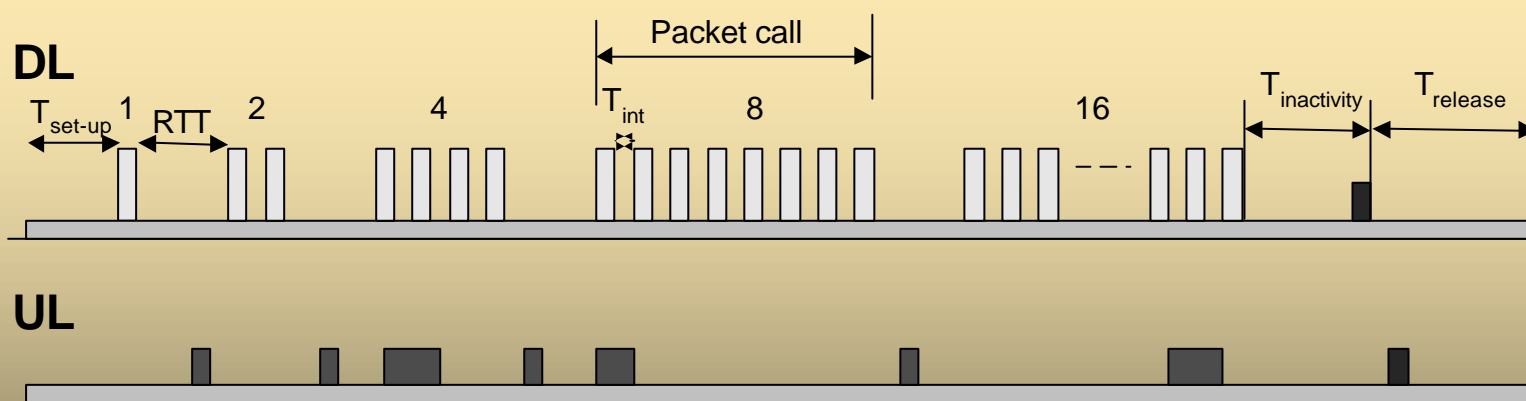■ Downlink Overhead
■ Uplink Overhead

Downlink Comparison

Use of DSCH Uplink IMPAIRS Downlink Capacity

DCH/DSCH DOWNLINK

Downlink

DSCH DATA	

FACH DCH CONTROL CHANNEL

DSCH DATA

FACH DCH CONTROL CHANNEL

CPCH/FACH DOWNLINK

Downlink

FACH DATA   FACH DATA
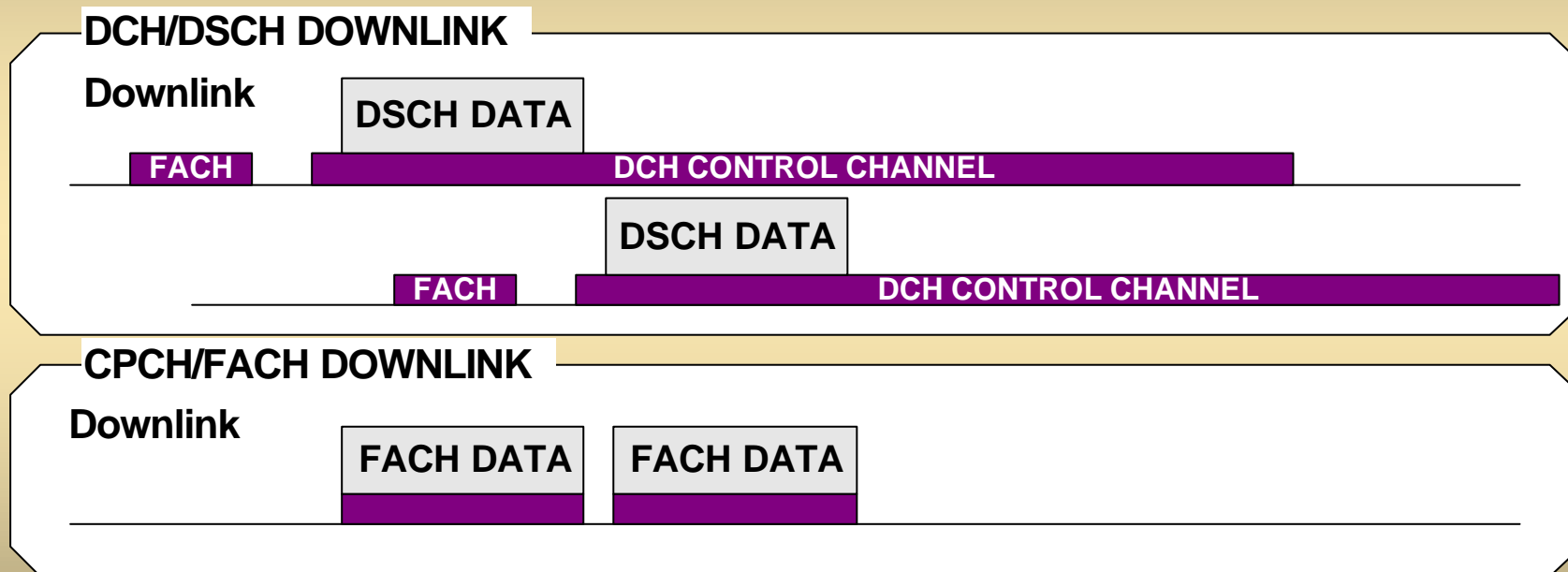
DCH/DSCH:CPCH/FACH Overhead ratio = 20:1   **Downlink Overhead**

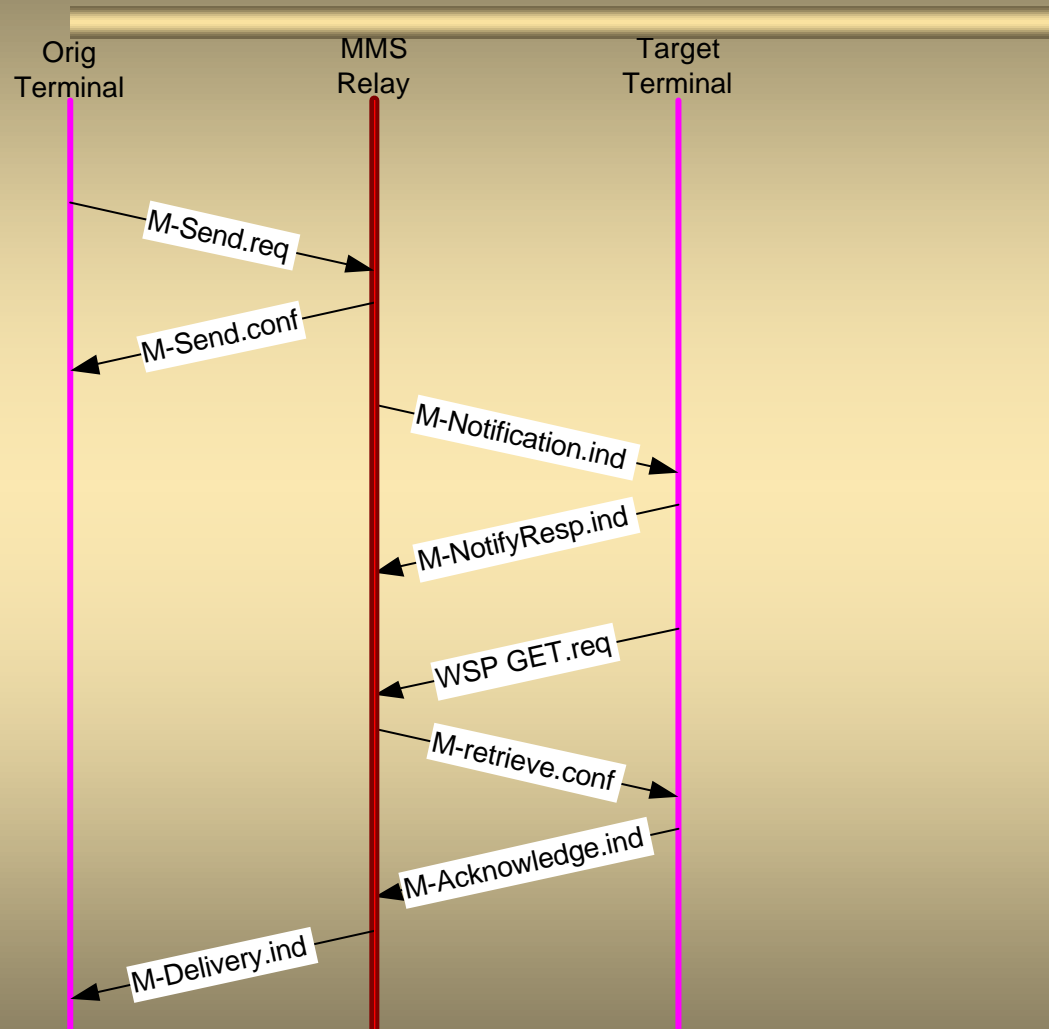# An example of bursty-ness introduced by TCP/IP

T: Transmission time per packet in ms

T_{set-up} :   Link set-up time in ms.

$T_{release}$:   Link release time in ms.

T_{int}:   Inter-packet arrival time in a packet call, 10 ms

$T_{inactivtiy}$:   Connection Release Timer (1 s)
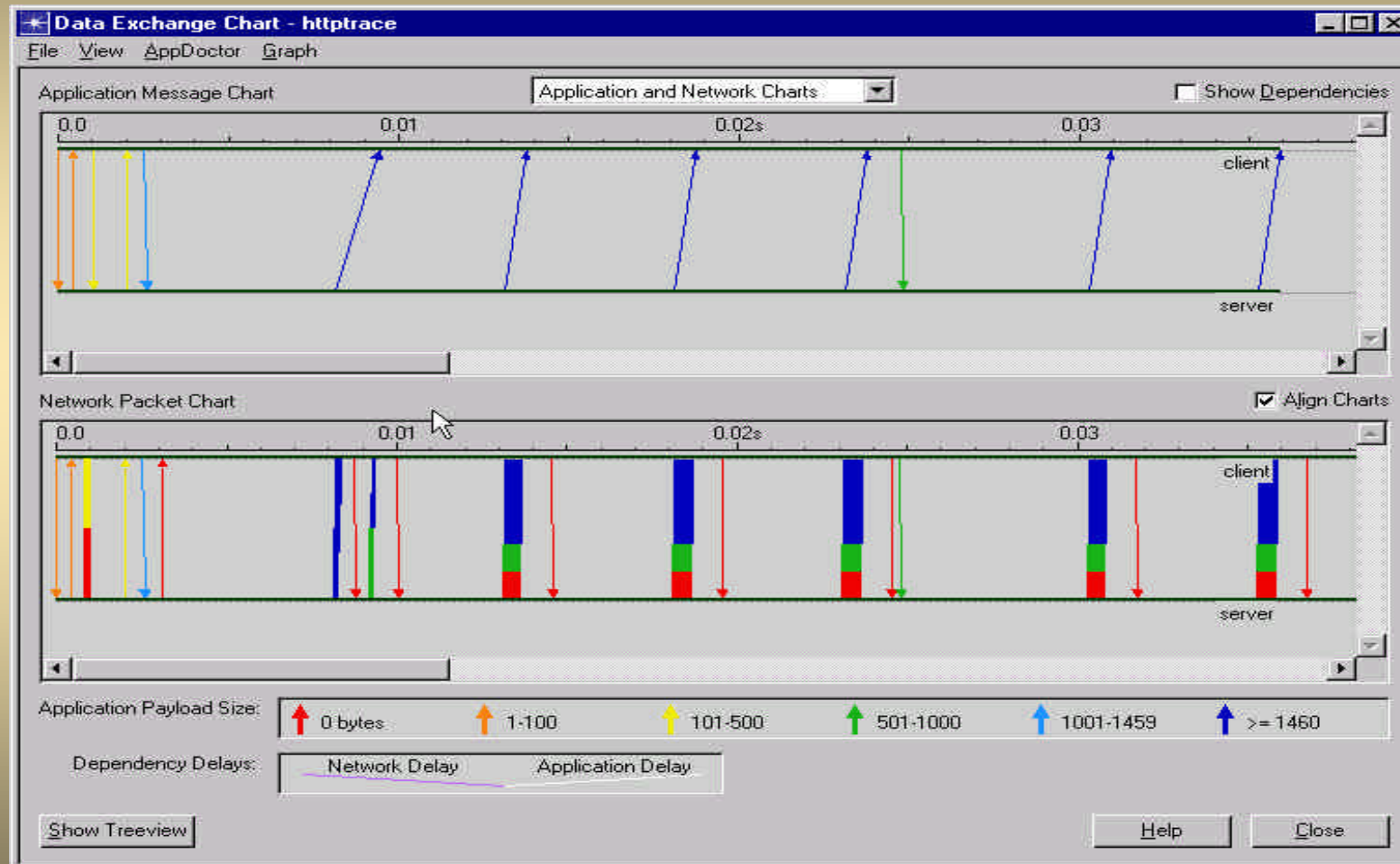
RTT: TCP-TCP Round Trip Delay

Example MMS Transactional Flow in WAP

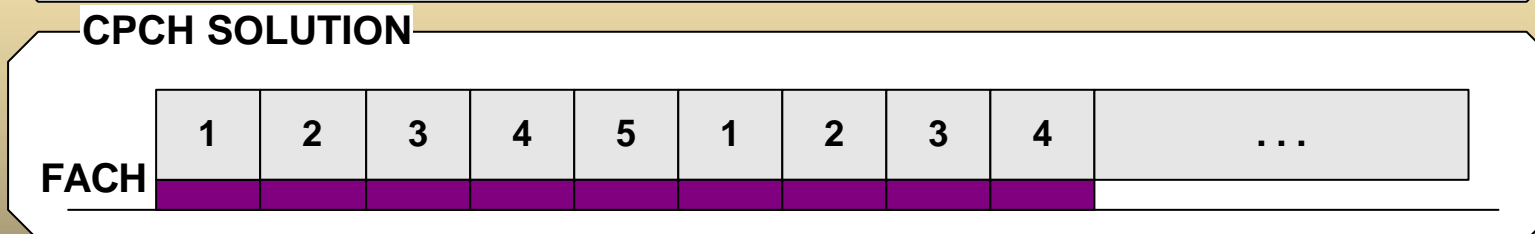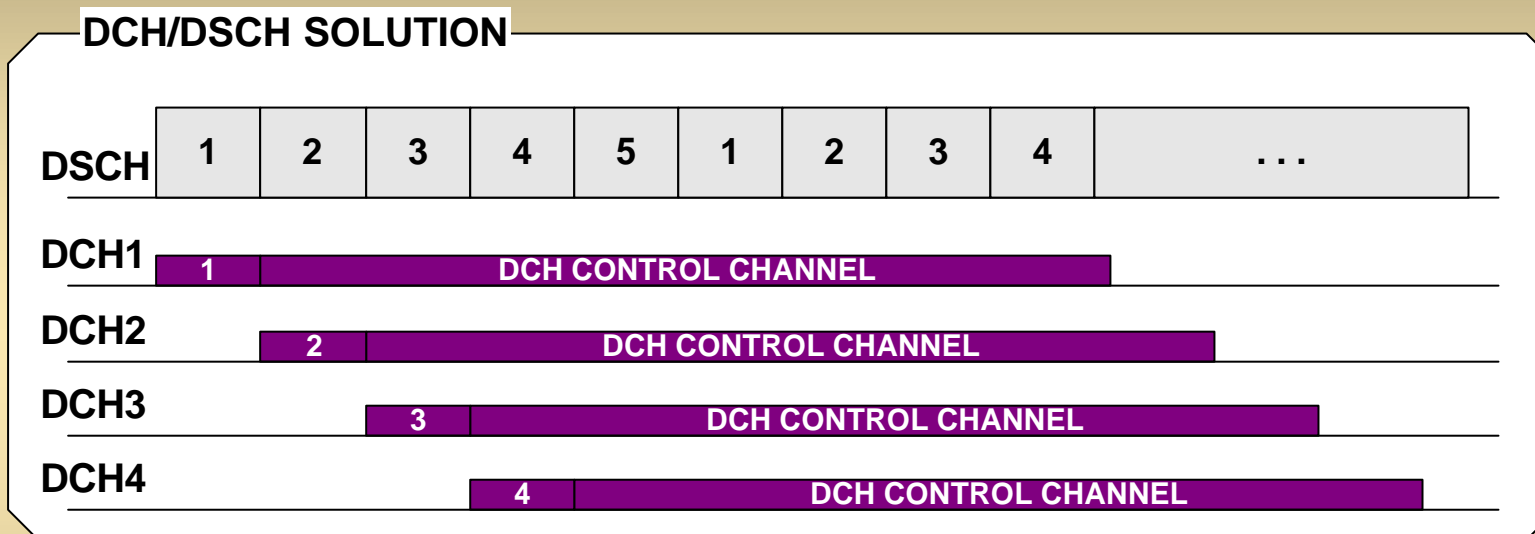Orig Terminal — MMS Relay — Target Terminal

M-Send.req

M-Send.conf

M-Notification.ind

M-NotifyResp.ind

WSP GET.req

M-retrieve.conf

M-Acknowledge.ind

M-Delivery.ind

DOWNLINK COMPARISON: Multiple Users Scenario

DOWNLINK COMPARISON: Multiple Users Scenario Compounds DSCH Overhead

DCH/DSCH SOLUTION

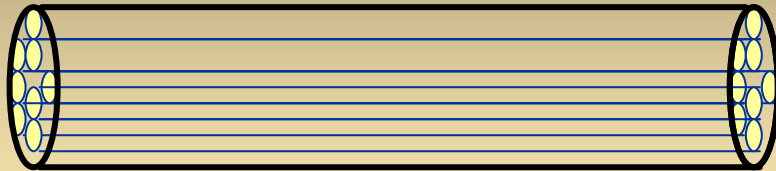| DSCH | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | . . . |

DCH1   1   DCH CONTROL CHANNEL

DCH2   2   DCH CONTROL CHANNEL

DCH3   3   DCH CONTROL CHANNEL

DCH4   4   DCH CONTROL CHANNEL

CPCH SOLUTION

| FACH | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | . . . |

█ **Downlink Overhead**

Uni-directional Uplink Transfer

DL: DCH

UL: DCH

U1 U1

U2

U3 U3

U4 U4

U5

DL: CPCH

UL: CPCH

U1 U2 U3 U4 U5 U1 U3 U4

Uni-directional Uplink Transfer (Control and Data)

DL: DCH

DL: CPCH

UL: DCH

U3 | U3

U2 | U1 | U4 | U5 | U1 | U4

UL: CPCH

U1 | U2 | U3 | U4 | U5 | U1 | U3 | U4
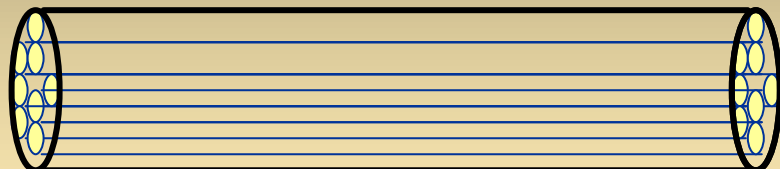
Capacity CPCH/FACH versus Circuit mode DCH/DCH+DSCH
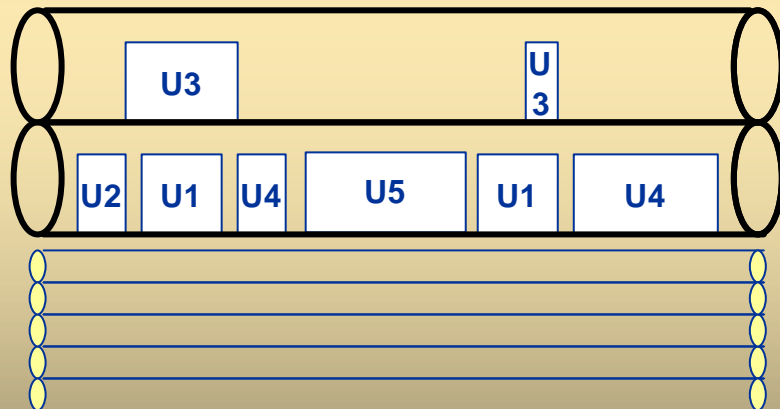
Uplink Direction: **CPCH capacity = 21 x DCH**
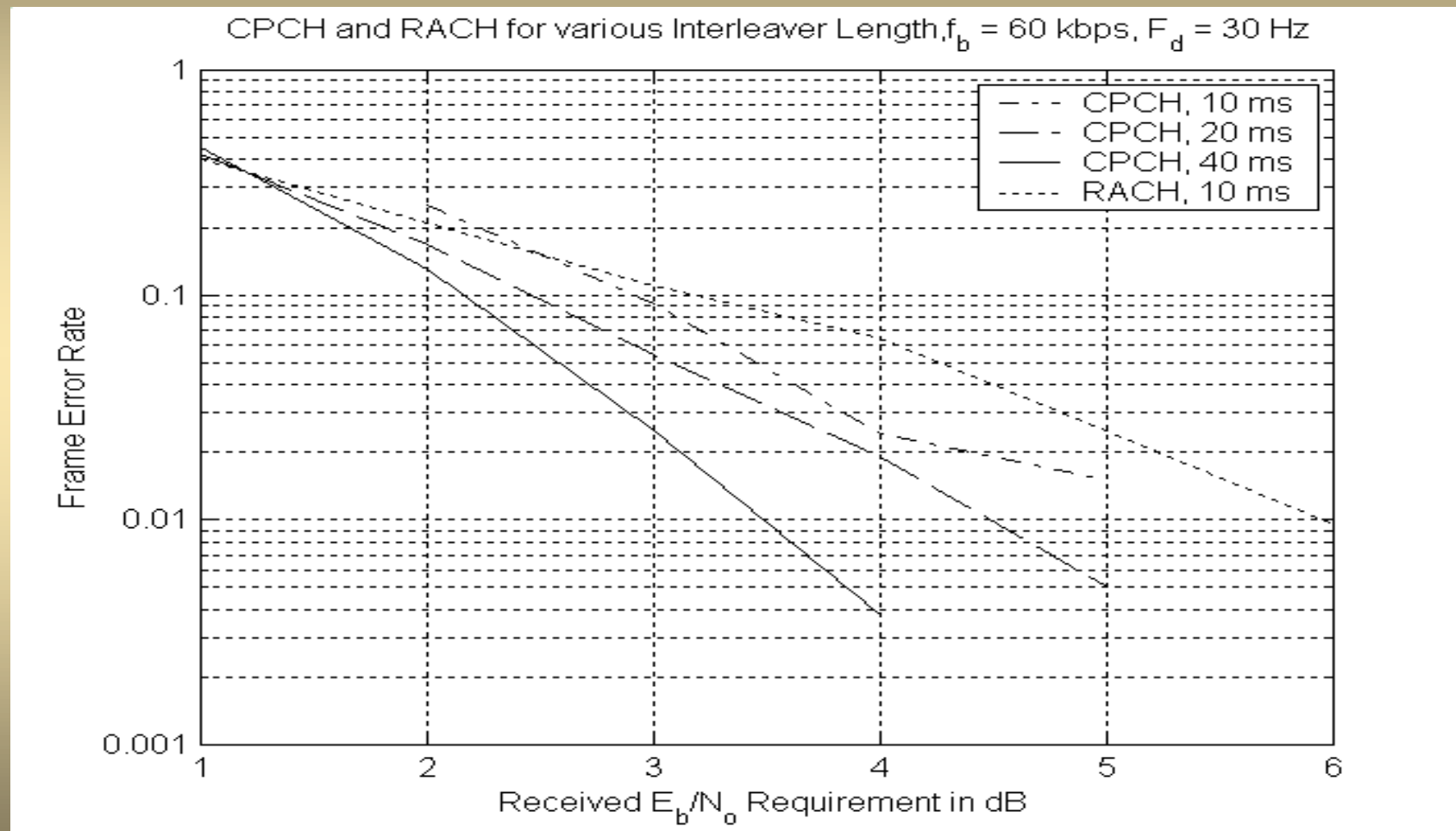
Downlink Direction: **DSCH (packet mode) or FACH capacity = 3.3 x   DSCH+DCH**
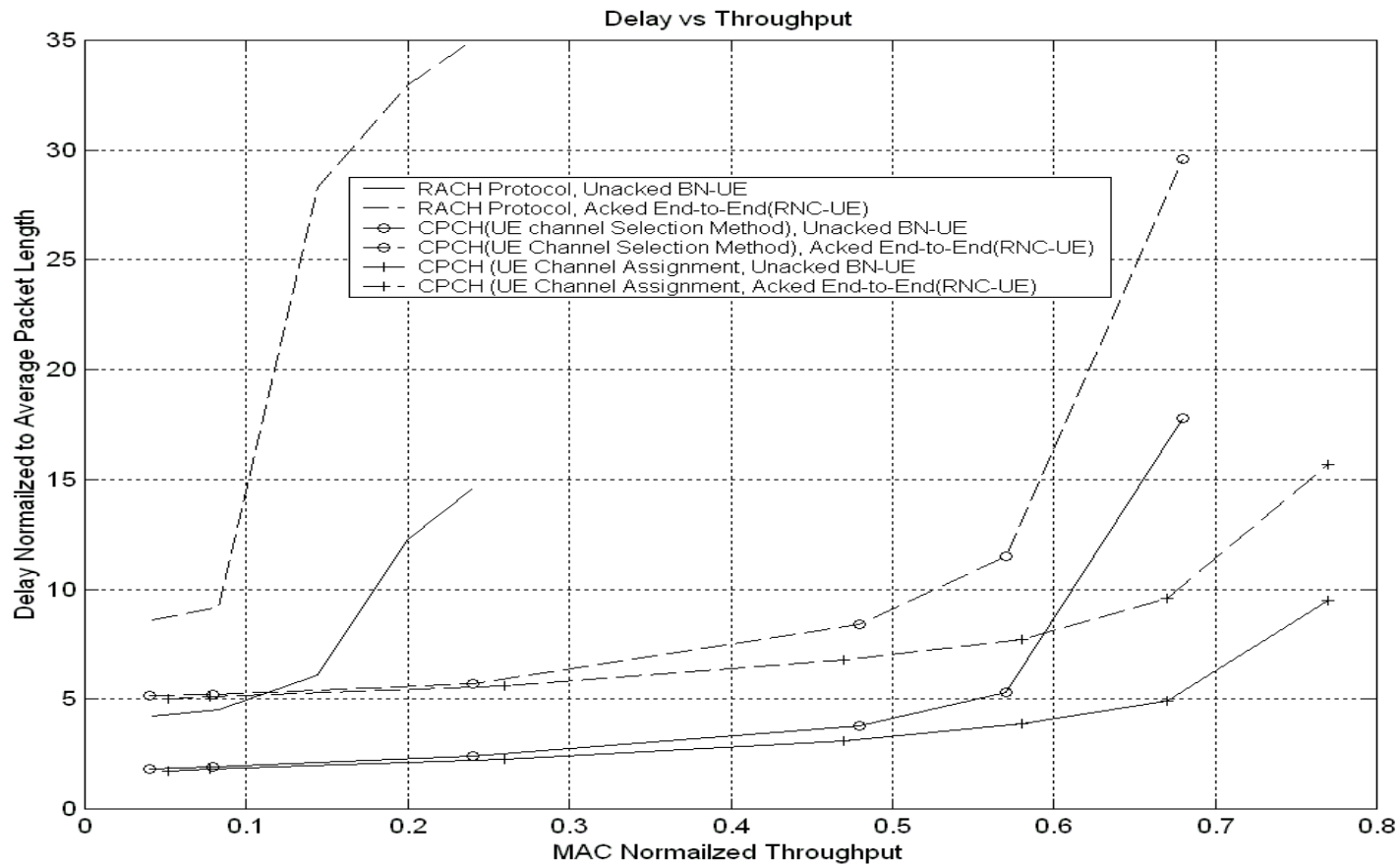
Reference: Joint paper by GBT, SBC, AT&T Labs (IST Mobile Summit 2000)

And the attached contribution by GBT, ADL, SBC

CPCH and RACH for various Interleaver Length, f_b = 60 kbps, F_d = 30 Hz

Legend:
- CPCH, 10 ms
- CPCH, 20 ms
- CPCH, 40 ms
- RACH, 10 ms

Y-axis: Frame Error Rate
X-axis: Received E_b/N_o Requirement in dB

Throughput delay performance of CPCH and RACH

Delay vs Throughput

Legend:
- RACH Protocol, Unacked BN-UE
- RACH Protocol, Acked End-to-End(RNC-UE)
- CPCH(UE channel Selection Method), Unacked BN-UE
- CPCH(UE Channel Selection Method), Acked End-to-End(RNC-UE)
- CPCH (UE Channel Assignment, Unacked BN-UE
- CPCH (UE Channel Assignment, Acked End-to-End(RNC-UE)

X-axis: MAC Normailzed Throughput
Y-axis: Delay Normalized to Average Packet Length

CPCH versus RACH

- **1.6-2 times more capacity due to less Eb/No requirement.**

- **3-4 times more throughput for CPCH and therefore 3-4 times less interference for CPCH as compared to RACH**

Gain Conclusions

1. Clear sizable capacity gain for short and medium size uplink messages

2. Clear capacity gain for majority of Non Real Services such as WWW, MMS, Location Based Services, Infotainment.

3. Clear Downlink and Uplink capacity gains with CPCH/FACH and CPCH/DSCH

4. Clear power saving advantage for terminal