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Agenda: 6.11
Source: Golden Bridge Technology
Title: Traffic characteristics of various 3G non-real time services
Document for: Discussion and Information

In this contribution, we present results of some applied research into the traffic characteristics of the non real time data services in 3G.The attached annexes provide source data and interim results which supports the conclusions listed here.

We have used the services and applications that have been mentioned in UMTS forum reports 9 and 11.

While the capacity gain of CPCH is widely acknowledged for bursty services and for certain uplink message sizes, there hasn't been much discussions in the area of "mapping the bursty mobile data services and applications" onto the appropriate W-CDMA bearers such as CPCH.

The information in this contribution makes a compelling case for mandating CPCH for "packet data-centric" services and applications for 3G deployments.

We will specifically present the results of our investigations into uplink message size for the following services, application categories and initial system signaling.Table 1 below presents these results.

Table 1.Uplink Message sizes for Data Services

Service	Range of Uplink Message Sizes
Multimedia Messaging Services (MMS)	[1 kbytes … 100 Kbytes]
Location Base Services	[Measurements 68 Bytes … 100 Bytes]
Mobile Internet [Uplink Requirements] Web browsing application	[10 Bytes … 1400 Bytes]
Transaction based Services (Mobile Commerce)	Medium size [Preliminary: > 100 Bytes]
Telemetry, Tele-medicine	Small to medium (Tele-Medicine may be much bigger if one includes e.g. X-ray pictures)
Signaling traffic to initialize the above listed service connections	[1 byte … 4 Kbytes]

CPCH system gain is realized for certain data traffic models with bursty NRT data. The following figure visually describes the traffic characteristics for which CPCH provides system gains.

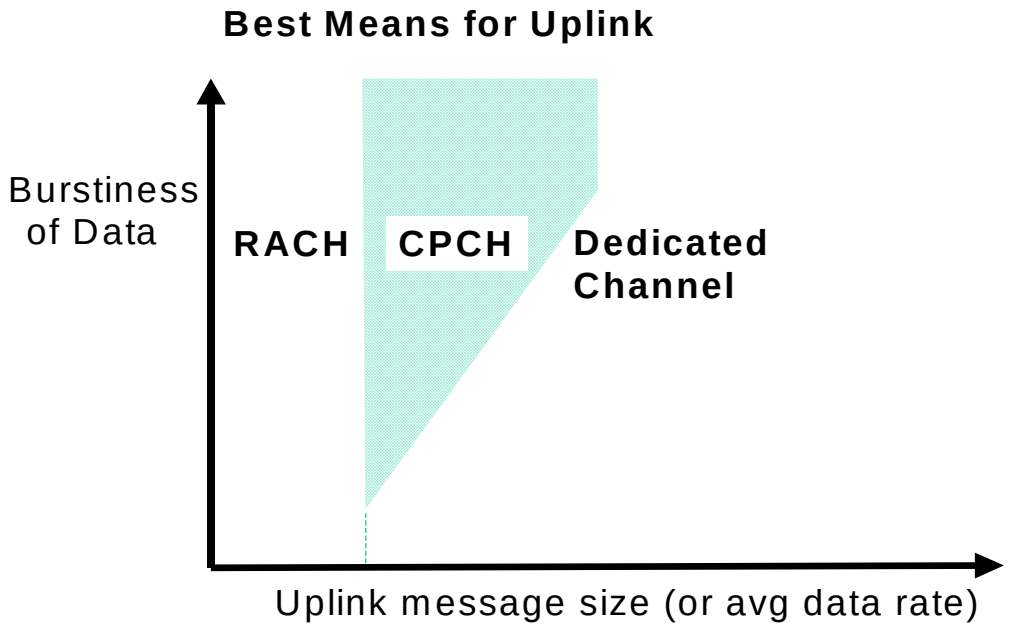


Figure 1.Data traffic for CPCH gains

CONCLUSIONS:

Below is the list of 3G services for which CPCH provides system benefits.

Refer to Annex A&B for details:

1. Unified messaging
2. M commerce transactions
3. email/messaging (text, graphic, image, video)
4. M2M (remote monitoring and surveliance)
5. B2B business applications
6. Multimedia messaging
7. Tracking, localized information
8. Location-based billing
9. Location-based M commerce
10. Navigation/ location
11. Entertainment
12. financial services
13. Mobile internet access
14. Mobile intranet access (office extension/ VHE)

Services which do not benefit from CPCH:

15. Advertising
16. news, horoscope, delivery
17. voice
18. streaming video/audio
19. Video telephone

Annex A

Web Browsing Simulation Results Using the Common Channels

Simulation Assumptions:

Web Browsing application:

- 8 objects per page
- Object size: Pareto distributed
- Shape factor =1.1
- Location factor = 4500 Bytes
- Average http page file size = 25 kbytes
- Maximum page size [cut-off = 200,000 bytes]
- Average reading time between packet calls = 120 seconds [100 Mobiles] (most pages are only “scanned”, so usually there are several clicks in a minute when people browse. Also on a WAP phone we calculate about 2 - 4 clicks in a minute)
- Fixed Network Delay of = 100 ms [Internet Delay]
- Add a round trip delay of 100 ms to the Base Station for an additional wireless network delay

Figure 1: Active sessions for the uplink and downlink common channels simulations

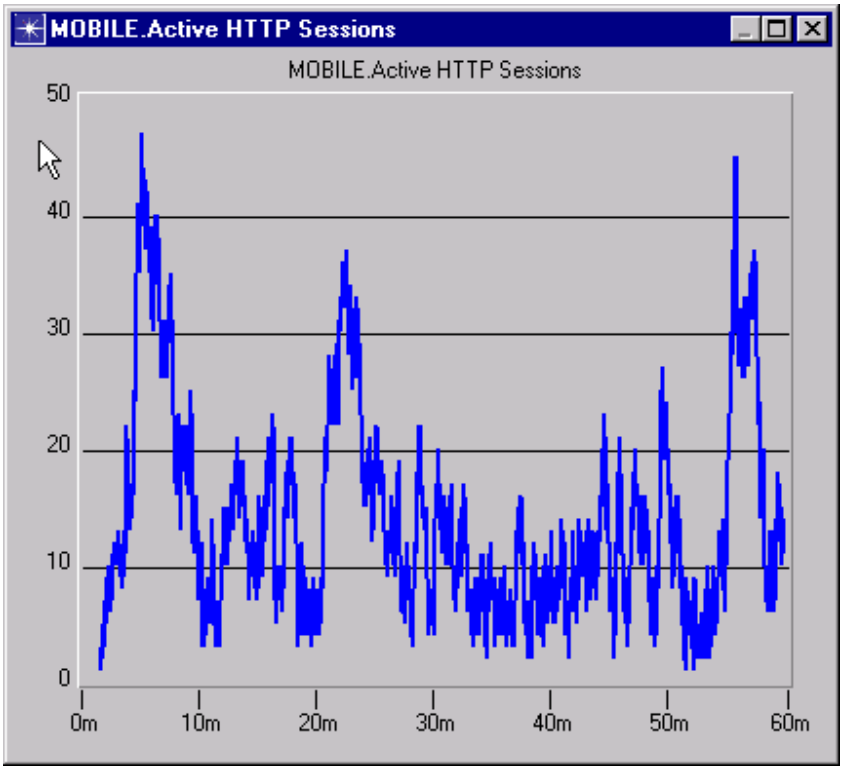


Figure 2: Page size distribution

Annex B

Table B1:Detailed list of suitability of CPCH for Data Services

Service	Uplink message size	Bursty-ness	TCP/IP (Y/N)	CPCH Fit (Y/N)	Interactive/ Uni-directional
Unified messaging	Medium	High	Y	Y	Uni-directional/ interactive
M commerce transactions	Medium	High	Y	Y	Ineractive
e-mail/messaging	Medium	High	Y	Y	Uni-directional/ interactive
Advertising	Downlink ONLY	High	?	N	unidirectional
M2M (telematics)	Medium	High	Y	Y	interactive
Info services	Downlink ONLY	High	Y	N	unidirectional
Voice	Real time N				
B2B business applications	Medium	High	Y	Y	Interactive

Multi-media messaging	**Medium**	**High**	**Y**	**Y**	**Interactive/inidirectional**
Streaming audio video	**High**	**Low**	**?**	**N**	**Uni-directional**
Tracking	**Small to Medium**	**High**	**Y**	**Y**	**Interactive**
Localized info	**Small to Medium**	**High**	**Y**	**Y**	**Interactive**
Location sensitive billing	**Small to Medium**	**High**	**Y**	**Y**	**Interactive**
Location-based m-commerce	**Small to Medium**	**High**	**Y**	**Y**	**Interactive**
Navigation/ location	**Small to Medium**	**High**	**Y**	**Y**	**Interactive**
Entertainment (example: playing games)	**Small to Medium**	**High**	**Y**	**Y**	**Interactive**
Financial services	**Small to Medium**	**High**	**Y**	**Y**	**Interactive**
Mobile internet access	**Small to Medium**	**High**	**Y**	**Y**	**Interactive**
Mobile intranet access	**Small to Medium**	**High**	**Y**	**Y**	**Interactive**

1. Multimedia Messaging Services (MMS)

Some examples of the services are: Instant Messaging (IM), Unified Messaging (UM), enhanced news services, e.g. the football results are supplied with the goal of the day), Chatting, EMS (EMS is based on multiple SMS that are put together in the receiving terminal).

The MM1 signaling required for MMS is tabulated in the following table:

Table 1:

PDU	Estimated Uplink Data Volume (octets)	Estimated Downlink Data Volume (octets)
M-send.req	1k … 1,100k	-
M-send.conf		~100
M-notification.ind	~100	-
M-NotifyResp.ind		~100
WSP GET.req	100 … 1k	
M-Retriev.conf		1k … 1,100k
M-acknowledge.ind	~100	
M-delievey.ind	100 … 1k	

Source: 23.140 (SA2)

2. Location Based Services

This table summarizes the basic uplink measurement report requirement [independent of the application level traffic] for location-based services. This measurements is sent by the UEs in the uplink direction once every few tens of seconds depending on the speed of the terminal and the size of the location service areas.

	Assisted	Non-assisted
GPS	21-149 Bytes Rangeof Sats = 0-6 Sats Reasonable Value (3 Sats)= 106 Byte (one needs usually 5 satellites)	10-30 Bytes Reasonable Value=30 Bytes
OTDA	14-186 Bytes Range of cells = 0-32 Reasonable value for 5 cells = 68 Bytes	10-30 Bytes Reasonable Value=30 Bytes

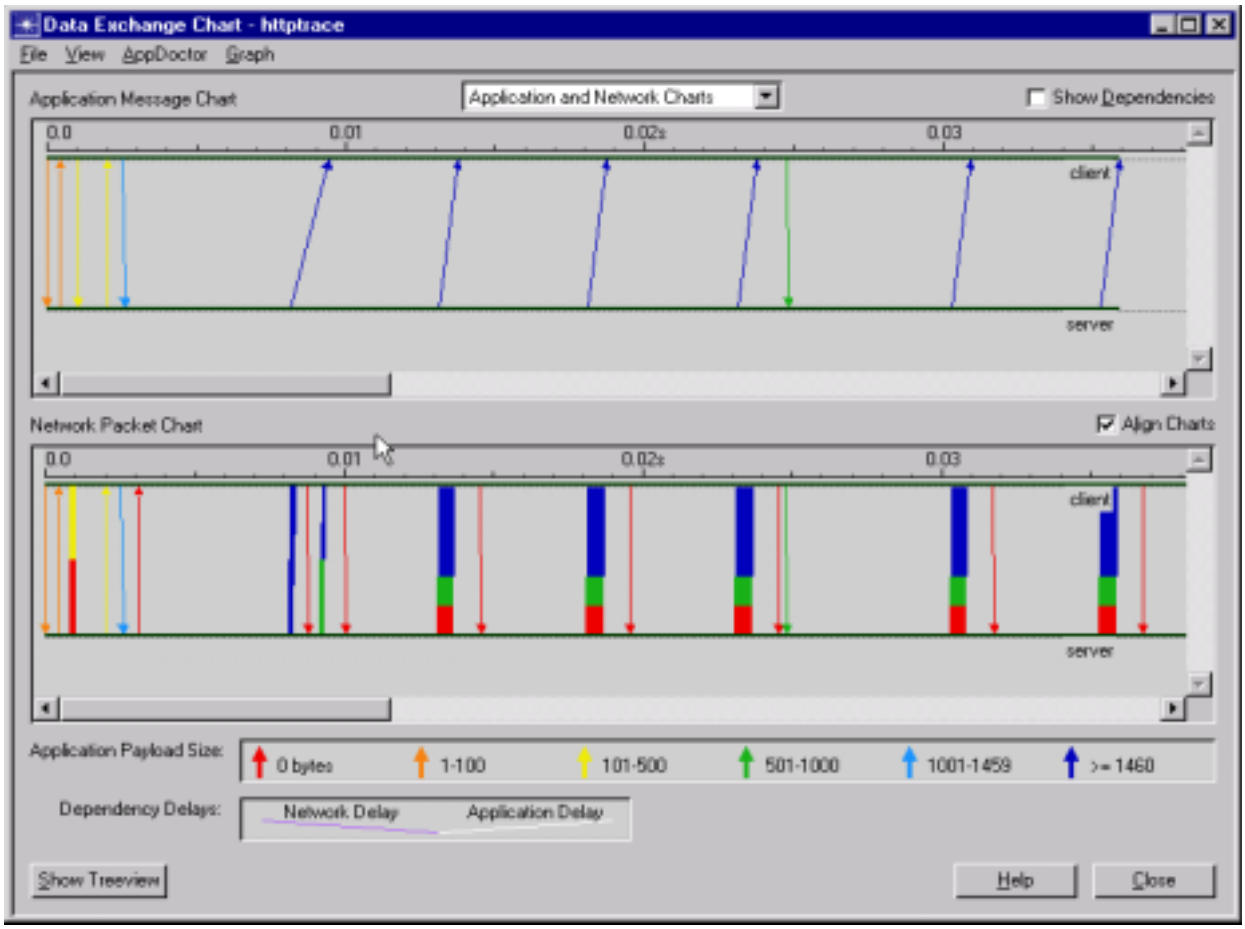
1. **Mobile Internet (Web browsing application)**

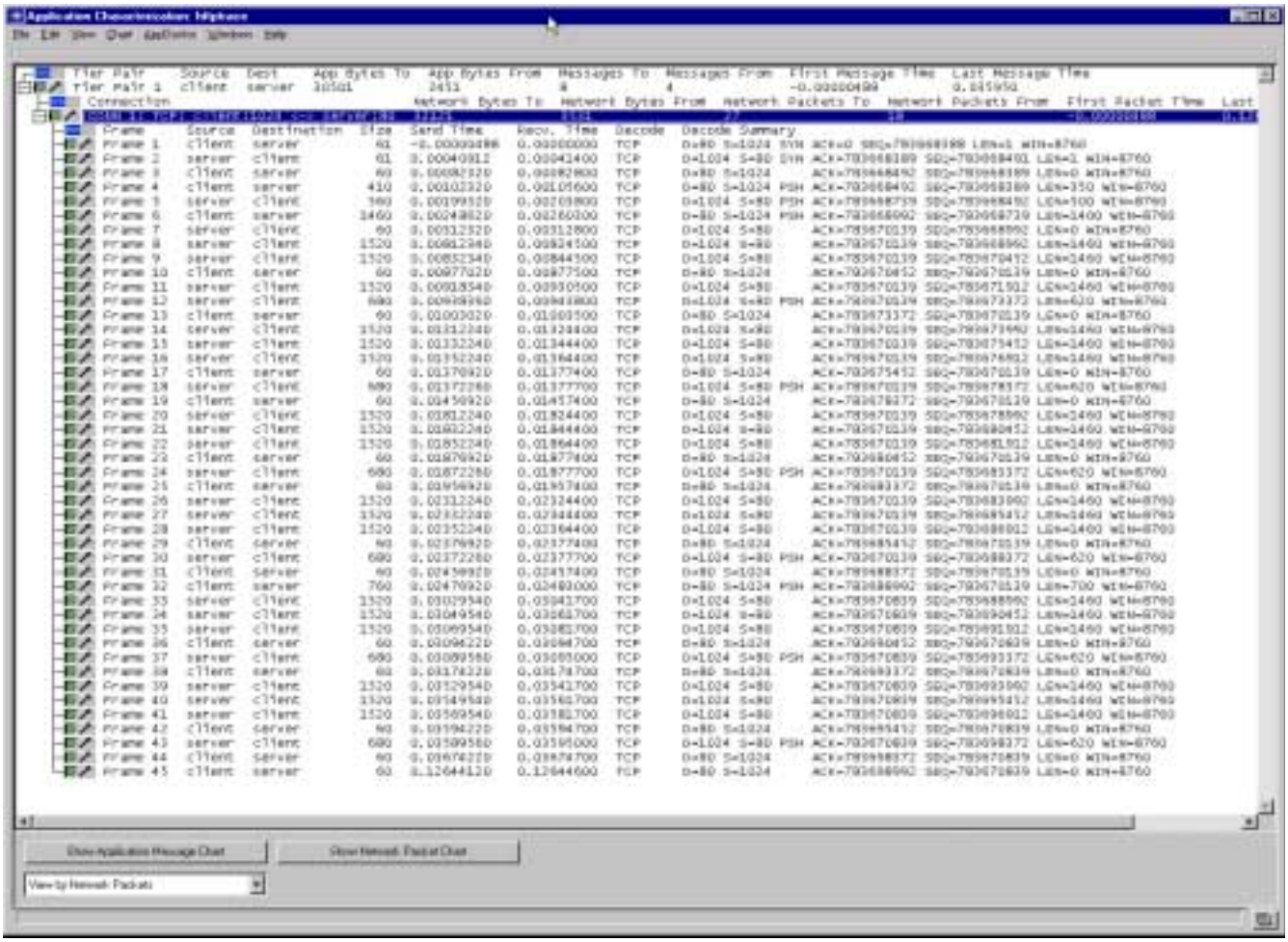
Two issues are of interest in this area:

   a. **What are message sizes in the uplink direction?**

b. What is the downlink/uplink asymmetry ratio in this application?

The following trace is from modeling of http in OPNET simulation tool. This figure shows the high level of bursty-ness of this application.

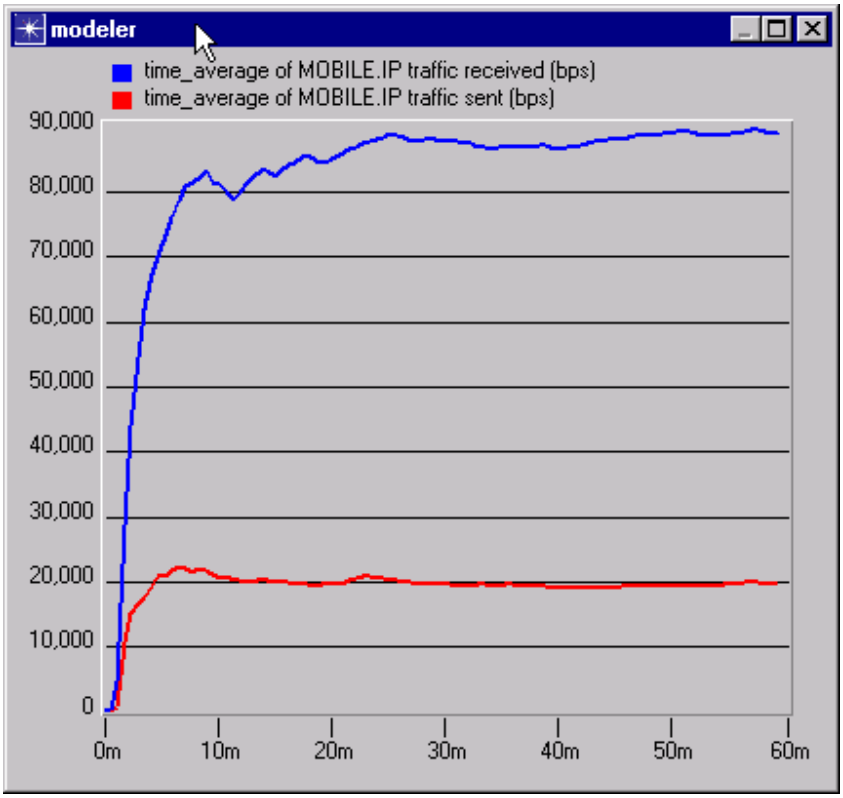




Description

1. TCP connection open request from client (SYN)
2. TCP connection opened indication from server (SYN)
3. SYN ACK from client completing three-way handshake
4. Client sends HTTP get message (350 bytes) for the page + 60 byte header (TCP + IP Ethernet) with a “PUSH” indicating that the file is complete—TCP sends file up to the application layer
5. HTTP page (500 bytes + 60 bytes) returned from server (with PUSH)
6. Client sends 4 HTTP gets (350 bytes/object) with PUSH
7. Server sends ACK
8. Server sends TCP segment (1460 + 60) after server processing delay to read objects.
9. Server sends next TCP segment (1460 + 60)
10. Client sends ACK
11. Server sends next TCP segment (1460 + 60)
12. Server sends last TCP segment for 1st object (620 + 60) with PUSH
13. Client sends ACK

Figure 1 illustration of downlink/uplink asymmetry for web browsing applications:



4. Transaction based Services (Interactive games, Mobile Commerce, B2C)

An example of such is mobile purchasing and mobile payment. This could typically be a few hundred bytes in the uplink direction. This item is under detailed investigation. (Games will bring much more traffic than m-commerce)

1. **Telemetry, Tele-medicine**

Uplink driven applications and services such as M2M, remote monitoring fit in the telemetry category. These applications require transmission of significant amount of traffic in the uplink on an occasional basis. Telemedicine applications also require uplink transmission of vital signs from the field in some applications. The sizes of the measurements in various applications could vary from tens of bytes to tens of Kilo bytes in the uplink direction. The details are under investigation. But it is clear that these applications require significant amount of bursty uplink information transfer.

2. **Initial system signaling**

The following example illustrates a sequence of signaling associated with GPRS data call set up. Most of the messages are less than 36 bytes. However, there are two instances that the message sizes exceed this level significantly. This might lead to earlier allocation and initialization of DCH (in absence of CPCH) which leads to higher levels of spectrum in-efficiency bursty circuit data call setup.

1.UE -> UTRAN: RRC Connection Request (10 Bytes)
2.UTRAN -> UE: RRC Connection Set up
3.UE -> UTRAN: RRCConnection Set up complete (190 Bytes)
4.UE -> CN: Attach request (14 Bytes)
5.CN-> UE: Identity request
6.UE->CN: Identity response (6 bytes)
7.CN -> UE: Attach Accept (11-37 Bytes)
8.UE-> CN: Attach Complete (2 Bytes)
9.CN-> UE: Authentication Request (19-37 Bytes)
10.UE->CN: Authentication Response (11 Bytes)
11.UE-> CN: Activate PDP Context Request (130 Bytes)
12.CN -> UE:Activate PDP context accept (5-281 Bytes)
13.RAN->UE: Physical Channel reconfiguration Request
14.UE - > RAN: Physical Channel reconfiguration Complete (60 Bytes)

7. Possible 3G services and percentages of their usage

It is helpful to see the size of the messages and degree of bursty-ness of various services and applications since it can facilitate the mapping of these services onto transport and physical channels. It is also instructive to see what the possible service segment utilization will be.

a. I-mode (UMTS report number 11): M-commerce based

Entertainment	**40%**
News and weather	**15%**
Ticket and living	**12%**
Stock trade	**8%**
Dictionary and phone book	**7%**
Travel	**8%**
Other	**10%**

a. UMTS forum (number 9) report services for 3G

Service	**Mobile**	**Mobile**	**Customized**	**MMS**	**Location**	**Rich**

	internet access	Intranet access	infotainment		based services	voice
Most popular activities	**News, e-mail, research, purchase, games**	**News, e-mail, research, purchase, ~~games~~**	**Games, news, purchases, communicating**	**Instant messaging, communicating**	**purchase**	**Comm..**
Speed requirement	**M to H**	**M to H**	**L to M**	**L to M**	**L**	**L**

a. Online activities (UMTS Forum report number 9)

Research	**90%**
Instant message	**50%**
Playing Games	**45%**
Making purchases	**45%**
Communicating with friends and family	**90%**
Getting news	**75%**