Title:

SUMMARY OF 3GPP/3GPP2 HARMONIZATION MEETING

for 13-14 November 2001 in East Brunswick, NJ.

Source:

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Abstract:

This document is a summary of the 3GPP/3GPP2 Harmonization meetings that were held during the period 13-14 November 2001 in East Brunswick, NJ.

Recommendation:

FYI.

Notice:

During the period of 13-14 November 2001, representatives of 3GPP TSG-RAN and 3GPP2 TSG-C met together at the East Brunswick Hilton Hotel in East Brunswick, NJ to consider issues associated with harmonization of HSDPA and 1xzEV-DV. This document is intended to summarize those proceedings.

1. CALL TO ORDER AND OPENING REMARKS: The meeting was called to order at 9:50 AM local time on 13 November 2001 by the Harmonization Meeting Chairs. The meeting leadership was introduced as follows:
   - 3GPP2 TSG-C WG5 Co-Chair, Ed Tiedemann (QUALCOMM)
   - 3GPP2 TSG-C WG5 Co-Chair, BK Yi (LGE)
   - 3GPP TSG-RAN Chair, François Courau (Alcatel)
   - 3GPP TSG-RAN2 Chair, Denis Fauconnier (Nortel Networks)
   - 3GPP TSG-RAN Secretary, Hans Van de Veen (ETSI)
   - 3GPP2 TSG-C Secretary, Clif Barber (Tantivy)

   The Chair noted that a call in facility was available for this meeting, sponsored as follows:
   - QUALCOMM provided the conference bridge
   - Tantivy Communications paid the long distance charges for the meeting room connection to the bridge
2. ATTENDANCE REGISTRATION AND INTRODUCTIONS: All meeting participants introduced themselves and their affiliation and noted their attendance on the sign-in sheet. Approximately 32 persons participated in the meeting. The sign-in sheet is included as an attachment to this report.
3. RECEIVE AND NUMBER CONTRIBUTIONS: Contributions were loaded onto the 3GPP2 network server and listed in the document register (000). Contributions were referenced within the meeting by the 3-digit number assigned by 3GPP2 TSG-C Secretary, Clif Barber (Tantivy). However, the group was advised that Clif Barber and 3GPP TSG-RAN Secretary, Hans Van de Veen (ETSI) would both be preparing separate meeting reports for their respective groups. The 3-digit contribution number would be referenced in these reports by the nomenclature for the applicable group.
4. CHAIR'S REMARKS:

   Both Chairs indicated their pleasure to participate in this meeting on behalf of their respective groups.

   The agenda was then reviewed and modified by the discussion.
5. ASSIGN CONTRIBUTIONS TO AGENDA ITEMS: Contributions were assigned to agenda items. The agenda was updated (001R1) and approved as modified

6. DISCUSSION OF THE GOALS OF THE WORKSHOP: The objectives of this meeting were defined as follows:

- To investigate potential relationships between 3GPP and 3GPP2 for harmonization activities.
- Review potential commonalties from the perspective of the terminal design
- To investigate options for continued discussions on this topic
- To produce a report to ITU-R WP 8F regarding the status of these discussions and gameplans for future discussions.

A contribution on HSDPA and 1xEV-DV harmonization opportunities (002) was presented by Bell Mobility. The issues noted included the following:

- OHG has been striving for harmonization of 3GPP and 3GPP2 technologies but WCDMA and CDMA2000 continue to diverge both in the IP core network and the radio interface. However, there are many similarities between HSDPA and 1xEV-DV.
- The ultimate objective for HSDPA and 1xEV- DV should be to differ only in bandwidth.
- The goal is to give operators flexibility to evolve to either WCDMA/HSDPA or cdma200/1xEV-DV technology as appropriate
- The ultimate goal should be to achieve minimal differences now, e. g. the five in the Toronto agreement, and a single access at a future date and a single IP core network. NOTE: The summary of the Toronto agreement (T001--TECH_FRAM) was loaded onto the server as FYI.
- Harmonization is beneficial from technical, economics, and business perspectives.
- The OHG vision of the progression of IMT-2000 was indicated as follows:
  - List of common features (focus of this meeting)
  - Common denominator Chip Rate - 2005
  - Spectrum/physical layer commonality - 2007
- Three (3) proposed harmonization alternatives were presented:
  - Alternative #1: Extension of the OHG agreement to cover hooks and extensions for the high speed data solutions.
  - Alternative #2: Alternative 1 + agreement on a common set of mandatory and optional parameters (based on review of key technical enablers).
  - Alternative #3: Alternative 2 + agreement on a common physical sub- layer for high speed data solutions.

7. PRESENTATION OF STATUS OF WORK:

- 3GPP: A verbal status report on HSDPA was presented by 3GPP, indicating the following:
  - All Stage 2 definitions have been completed
  - All core technologies will be finalized in December 2001

- All performance specifications and Stage 3 text are now targeted for completion in March 2002.
- The items are included in 3GPP Release 5 which includes HSDPA with the All IP option.
- The 3GPP workplan, in Microsoft Project, is available on the 3GPP website.

- 3GPP2: A contribution on the status of development of CDMA2000 1xEV-DO and 1xEV-DV in 3GPP2 (003) was presented by 3GPP2, indicating the following:
  - 1xEV-DO standards published
    - Air interface specification, C. S0024
    - Performance specifications, C. S0032 and C. S0033
    - A interface (IOS) modifications, A. S0007
    - Several other areas of modifications (e. g., OTA)
  - 1xEV-DV status
    - Development is currently in progress
    - Working to updated ITU- R date of May 31, 2002 for transposition to be completed by at least one SDO
    - Will be part of Revision C of CDMA2000
    - The basic 3GPP2 development process is detailed in a block diagram in the contribution.
    - The TSG-S Stage 1 process and primary requirements were also detailed as follows:
      - Relative to CDMA2000, at least two times the number of concurrent voice calls for a single radio channel
      - Peak data rates (data only): at least 2. 4 Mbps on the forward bearer channel
      - Peak data rates (data only): at least 2 Mbps (1.25 Mbps in a vehicular environment) on the reverse bearer channel
      - Average throughput per sector (data only) 600 kbps on both forward and reverse bear channel
      - Multiple traffic types, support for QoS
    - The TSG-C WG5 process was also detailed including the WG5 deliverables.

- There was general agreement that there was substantial commonality between the 3GPP and 3GPP2 processes, except for naming conventions. However, 3GPP focused on this effort as an evolution to the existing radio architecture and did not go through the Stage 1 requirements development. In addition, 3GPP2 focused primarily of the new radio interface and not so much on the applicable services where 3GPP TSG-SA did drive additional associated service definitions.

8. PRESENTATION OF TECHNICAL MATERIALS:

- 3GPP
  - An HSDPA presentation (008) was presented by 3GPP, indicating the following:
    - HSDPA objectives
      - Increase maximum user throughput for downlink packet data
      - HSDPA architecture is a straightforward enhancement to the Release 99 architecture
      - Standardization of all interfaces
    - HSDPA operation: Node B is enhanced to handle the following:
      - HARQ retransmissions
      - Modulation/coding selection
      - Packet data scheduling
    - Study in year 2000 (Release 4) indicated a doubling of capacity compared to Rel'99 (dependent on assumptions, such as scheduler and cell isolation)
    - Key additions to Release 99
      - Adaptive Modulation
      - Hybrid ARQ
      - Scheduling/repetition at Node B
      - Shorter radio frame
    - Primary architecture enhancements to Release 99 include the following:
      - Addition of a MAC HS-DSCH entity in Node B
      - Declaration of the entire DRNC layer as optional
    - HSDPA is compatible with all transport options, not just All IP.
      - No Impact on RLC
      - New RRC parameters
      - No impact on mobility
      - UTRAN functional hierarchy still valid
    - HSDPA radio interface functionality:

- Several users can be code multiplexed together . This allows better granularity than with time multiplexing only and takes terminal capability into account (all terminals are not going to be 10.8 Mcps terminals)
- Node B has information of the transmission power for each terminal (Power control commands from the terminal) + ACK/NACK feedback info in the uplink
- The number of codes used for HSDPA can vary dynamically between 1 and 15, terminals expected to have varying code handling capability as in Rel'99/Rel'4.

- HSDPA downlink Physical Layer includes:
  - HS-PDSCH – fixed spreading factor = 16 (all channelization codes with same scrambling code)
  - HS-DSCH FDD has frame length (TTI) of 2 ms (3 slots)
  - HS-SCCH – shared control channel – SF=128 or 256 (under study)
  - UE can be assigned multiple physical channels based on its capability
  - Code division multiplexing of UEs within one TTI is allowed
  - QPSK and 16-QAM allowed
- Examples of future HSDPA enhancements:
  - More modulations
  - MIMO
  - Multiple simultaneous receptions in terminal
  - New associated DPCH structure
  - HSDPA is part of UTRAN release 5, and will be improved along with the other UTRAN features

- A contribution on HSDPA - Simulation Assumptions in 3GPP (009) was presented by 3GPP, indicating the following (a more complete description is included in TR25.848):
  - The simulation parameters include the following:
    - Link Level Parameters
    - System Level Parameters
    - Data Traffic Model - simulates bursty web traffic. The parameters of the model have been tailored to reduce simulation run time by decreasing the number of UEs required to achieve peak system loading.
    - UE Mobility Model
    - Packet Scheduler
      - Two simple schedulers have been defined that bound performance.

- The first scheduler (C/I based) provides maximum system capacity at the expense of fairness, because all frames can be allocated to a single user with good channel conditions
- The Round Robin (RR) scheduler provides a more fair sharing of resources (frames) at the expense of a lower system capacity.
- Other schedulers have been used as well in later phases (proportionally fair etc.)

- Performance Metrics
- On-going Activity
- Coming Developments:
  - Several issues impacting the future simulation assumptions are expected to be decided shortly such as HARQ details with non-identical retransmissions etc.
  - The TX diversity/MIMO channel model will also be discussed in the next TSG-RAN2 meeting.

- 3GPP2
  - The 1xEV-DV Forward Link Overview (004) was presented by 3GPP2, indicating the following:
    - Key aspects of current 1xEV-DV Forward Link design:
      - Fully maintains existing CDMA2000 channels and signaling structure
      - Set of fixed packet sizes (384, 768, 1536, 2304, 3072, and 3840 bits)
      - Variable packet durations (1.25, 2.5, 5, and 10 ms)
      - Channel sensitive scheduling
      - C/ I feedback rate of 800 Hz
      - Scheduling time granularity of 1. 25 ms
      - Asynchronous retransmissions
      - Adaptive modulation and coding with higher- level modulation schemes (QPSK, 8- PSK, and 16QAM). Modulation can be changed for retransmission (asynchronous adaptive incremental redundancy - AAIR)
      - Variable duration code- division multiplexed common control channels (1.25, 2.5, and 5 ms)
      - Synchronous acknowledgments
      - Using existing CDMA2000 turbo codes, Quasi- Complementary Turbo Code (QCTC) interleaving
      - TDM/ CDM capability included, exact details under study

- New Forward Link Channels
  - Forward Packet Data Channel (F- PDCH):
    - Shared by packet data users
    - Consist of a number of code- division- multiplexed quadrature Walsh subchannels, each spread by 32- ary Walsh function
  - Forward Primary Packet Data Control Channel (F- PPDCCH):
    - Used to indicate the Sub- packet Length (duration) of F- PDCH (and of F- SPDCCH implicitly)
    - Optional (when blind decoding on F- SPDCCH)
  - Forward Secondary Packet Data Control Channel (F- SPDCCH): Used to send the scheduled user's MAC ID, ARQ Channel ID, Encoder Packet Size, and Sub- packet ID for most of the time; Used to broadcast available Walsh space information when needed
- Reverse Link Channels that Support Forward Link Packet Data Operation
  - Reverse ACK Channel (R- ACKCH): ACK Channel to indicate to the base station whether a sub- packet transmitted on the F- PDCH was received successfully or not
  - Reverse Channel Quality Indicator Channel (R- CQICH): Used by the mobile station to indicate to the base station the channel quality measurements of the best serving sector
- Forward Link operation overview:
  - The BS transmit power and code space is dynamically shared between the rate controlled packet data users and power controlled circuit switched voice/ data users
  - The Forward Link for the power controlled circuit switched voice/ data is identical to CDMA2000 1x
  - The rate controlled packet data users share a common channel with dynamically changing code space and power
  - Each 1xEV- DV mobile continually measures the C/ I from all active BS's using the continuous F- PICH. The mobile selects the best serving cell based on the measured C/ I
  - The mobile transmits the C/ I based on the serving sector pilot every 1.25 ms (CDMA2000 power control group) back to the base station on the R-CQICH
  - The BS, determines the highest priority user(s)

- The BS collects the C/ I feedback from all active users on the R-CQICH and schedules the transmission of the user control information and data to the users in a time- multiplexed/ code multiplexed (primarily time- multiplexed) fashion
- The exact rate of the Forward Link transmission depends on the operation of the asynchronous and adaptive incremental redundancy operation
- The transmission rate is explicitly indicated to the mobile via the F-SPDCCH
- If the MS receives a transmission on the F- SPDCCH, the MS decodes the corresponding data packet on the F- PDCH
- If the mobile decodes the data packet on the F- FPDCH correctly, it sends an ACK (positive acknowledgment) to the BS. Otherwise, it sends a NACK (negative acknowledgment) to the BS
- The power control bits for the mobile's reverse link operation are signaled via the IS- 2000 F- CPCCH common power control channel

- 1xEV-DV Forward Link study items/components
  - Estimation of traffic to pilot ratio for F- PDCH and rate at which F-PDCH power can be varied (closed)
  - Modulation schemes for retransmission
  - Enhancements to IR
  - Number of MAC ID
  - Efficient C/ I feedback (differential feedback)
  - 64QAM
  - Performance enhancements for small packets
  - Fast Cell Selection
  - 1.25 ms slot size
  - Number of ARQ channels and possible relaxing of timing requirements
  - Generating CRC with MAC ID
- 1xEV-DV component technology proposals
  - Antenna concepts
    - Adaptive antennas
    - 4- way transmit diversity
    - Selection Transmit Diversity (STD)
    - Multiple Input Multiple Output (MIMO)
    - Differential Measurement Metric (DMM)
  - Cell Selection Soft Handoff

- LA and LS spreading codes
- Maintenance Channel
- Multiple Quality Control (MQC)

- The 1xEV-DV Reverse Link Overview (005) was presented by 3GPP2, indicating the following:
  - Main Features of Reverse Link Proposals
    - Backward compatibility with CDMA2000 1x
    - Combination of TDM/ CDM operation
    - Scheduling and congestion control mechanisms
      - Shared packet data channel (fast scheduling)
      - Autonomous transmission with congestion control
      - Combinations thereof
    - Frame sizes
      - Fixed (2. 5, 5, and 20 ms)
      - Dynamically variable frame sizes (multi- frames are also possible)
    - Transmission rate
      - Fixed, based upon scheduling
      - Fixed, based upon scheduling with some MS autonomy
      - Totally autonomous by MS
    - Adaptive Modulation and Coding
    - Physical layer ARQ
      - Simple energy combining
      - Simple incremental redundancy
      - Asynchronous adaptive incremental redundancy
  - Other Reverse Link Aspects
    - Quasi- Active State for packet data applications to improve power consumption
    - Higher data rates than CDMA2000 - proposed up to 2.4 Mbps in 1.25 MHz
    - Interference cancellation
    - Control signaling on Forward Link to support Reverse Link
    - New control channels (CDMA2000 1x) to enable fast RL operation
    - Spatial/ Time diversity (e. g., STS, MIMO)
    - Spectrally efficient spreading codes

- Better use of common channels for efficient transmission of short data packets
- Code orthogonal reverse link

- Status of Reverse Link Proposal Evaluation
  - Performance results for the various proposals are being examined prior to reaching a framework
  - Merits of scheduling approaches: “fast” scheduling, “autonomous” transmission, and a combination thereof are being considered

- The 1xEV-DV evaluation methodology (005) was presented by 3GPP2, indicating the following:
  - Objective and Overview
    - Goal is to describe a common simulation environment for simulating 1xEV-DV systems
    - Evaluations are to be simulated using the common simulation environment
    - Developed 89 page “Evaluation Strawman” document
    - Covers both Forward Link and Reverse Link
    - Provides
      - Definitions
      - Assumptions
      - Methodology
    - Primarily consists of a description of:
      - Link level simulation
      - System level simulation
  - Evaluation included:
    - Link Level Modeling
    - Short Term Voice Curves for Traffic Model A (1 path 3 km/hr)
    - System Level Simulation
    - Channel Models
    - Traffic Models
    - Delay/Outage Criteria
    - Fairness Criteria (FTP Full Buffers)
    - Mix of Service

9. DISCUSSION OF WORK ON CHANNEL MODELING:

- A contribution on Spatial Channel Modeling in 3GPP2 TSG- C (007) was presented by 3GPP2, indicating the following:

- Spatial Channel Modeling AdHoc overview and status
  - WG5 Spatial Channel Model Ad- Hoc created to:
    - Define spatial channel characteristics and simulation methodology
    - Establish the framework under which to evaluate multi-antenna component technologies in 1xEV-DV
  - Contributions to the Ad- Hoc focus on definitions that accommodate a broad range of antenna technologies:
    - Multiple Input Multiple Output (MIMO)
    - Multiple Input Single Output (MISO)
    - Single Input Multiple Output (SIMO)
    - Diversity and Beamforming based techniques
  - Ad- Hoc's activities are currently in progress.
- Goals
  - Define spatial channel models for link & system level analysis that are representative of realistic environments
  - Define spatial channel models for link & system level analysis that are easily repeatable, and computationally mild
- System Level Spatial Channel Modeling
  - Objective: Define Methodology for System Wide performance evaluation of multi-antenna schemes.
  - System- Specific Spatial Parameters defined:
    - Incorporate all scalar channel assumptions and channel model mixture from Evaluation Methodology Assumptions (WG5)
    - Mobile - Base Station positions
    - Angle of Arrivals at BS, MS relative to broadside
    - Random MS orientation
    - Per path delay spatial parameters as defined in link level assumptions
    - Explicit modeling of Forward Link interference (in terms of AS, AOA)
    - Determination of Forward Vector/ Matrix Channel Quality using appropriate metric (currently open issue).
      - Metric Specific to MIMO/ MISO/ SIMO technique used at the terminal
      - Metric accounts for in- cell and out- of- cell interference

- Each multi-antenna component proposal must be accompanied by its system metric definitions
- Proposals must include metric to FER mappings for system level performance evaluation

- Possible 3GPP- 3GPP2 Commonality
  - Would it make sense to have a common 3GPP2- 3GPP channel model?
  - A common 3GPP2 - 3GPP channel model would:
    - Enable cross-verification of proposed technologies
    - Make performance results directly comparable
    - Broaden the acceptance of antenna technologies through the use of common simulation framework
    - Accelerate the standardization of proposed schemes

10. DISCUSSION OF WORKING TOGETHER:

- : The following suggestions for joint work were presented for consideration:
  - Channel modeling
  - Simulation model
  - Definition of goals and time plans for future activities.
  - Minimal deviation/maximize commonality for fundamental terminal parameters and hardware design requirements.
  - Other areas of harmonization that will not be addressed by this group include the following:
    - Common services
    - Common spectrum (being addressed by WP 8F)
    - Common core network (All IP - also addressed in other fora)
  - Need to establish a better way of communicating between the two (2) organizations and a commitment from both sides to the interworking process.
  - There was general consensus that pursuance of minimal deviation/maximize commonality for fundamental terminal parameters and hardware design requirements. This would support following:
    - Dual mode terminals would have a common hardware platform for both modes.
    - Common development platforms for companies developing products for both markets.
    - Economies of scale via use of common components wherever possible.

The following items could possibly serve initial foci of this effort:

- MIMO
- Channel modeling
- Simulation model development

The group stressed that this was a long term goal and must not impact any current activities (i.e., the release of current standards to meet ITU-R WP 8F timelines). In addition, there was a suggestion that, based on the fact that the two (2) groups have different processes and procedures in place, that working together is an effort that should start with small, achievable objectives and that will build over time as the working relationship gets stronger.

11. DETERMINATION OF NEXT STEPS:

- 3GPP will launch a harmonization process e-mail exploder to link the technical leaders of both groups. This exploder will facilitate preliminary discussions. exchange of work plans, etc.
- Both 3GPP and 3GPP2 groups will be solicited for a certain amount of flexibility to setup interworking processes as the understanding between the groups increases.
- An adhoc developed a draft of the meeting output report (010) and that report was approved without objection as modified by the discussion (010R1).

12. OPEN DISCUSSION:

- The Chairs thanked the attendees for their attendance and participation. The Chairs also thanked 3GPP2 for their organization of the meeting.

13. ADJOURNMENT: The meeting was adjourned on 14 November 2001 at 1:50 PM local time.

A listing of the contributions that were distributed is itemized below:

NUMBER	SUBJECT	SOURCE
OPENING PLENARY - 3GPP2-C00-HARM-20011113-		
000	DOCUMENT REGISTER	SECRETARY
001	AGENDA	CHAIR
002	HSDPA and 1xEV-DV Harmonization Opportunities	BELL MOBILITY
003	Development ofcdma20001xEV-DV/1xEV-DO in 3GPP2	3GPP2
004	1xEV-DV Forward Link Overview	3GPP2
005	1xEV-DV Reverse Link Overview	3GPP2
006	1xEV-DV Evaluation Methodology	3GPP2
007	Spatial Channel Modeling in 3GPP2 TSG-C	3GPP2
008	HSDPA presentation	3GPP
009	HSDPA simulation	3GPP