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REVIEW ON PACKET TELEMETRY AND CONCEPTS ON PACKET TELECOMMAND: INPE PROPOSAL TO CCSDS/PANEL 1

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14. Abstract/Notes

Concepts for packet telemetry and telecommand are proposed for CCSDS/Panel 1. The propositions are inspired on the NASA/ESA concepts for packet telemetry as presented to CCSDS in 1982. The extended concepts would permit symmetric treatment of data acquisition and control by means of communicating end-to-end processes.

15. Remarks * *This work will be presented in the Consultative Committee on Space Data Systems - CCSDS Panel 1 meeting on Telemetry, Tracking and Telecommand - TTC, to be held at ESOC, Darmstadt, West Germany, July 4th through July 8th, 1983.*

RESUMO

SÃO PROPOSTOS CONCEITOS PARA TELEMETRIA E TELECOMANDO POR PACOTES PARA O PAINEL 1 DO CCSDS. AS PROPOSIÇÕES ESTÃO INSPIRADAS NOS CONCEITOS PARA TELEMETRIA POR PACOTES QUE FORAM APRESENTADOS AO CCSDS EM 1982. OS CONCEITOS ESTENDIDOS PERMITIRIAM O TRATAMENTO SIMÉTRICO DA AQUISIÇÃO E CONTROLE DE DADOS POR INTERMÉDIO DE PROCESSOS FIM-A-FIM QUE SE COMUNICAM ENTRE SI.

REVIEW ON PACKET TELEMETRY AND CONCEPTS ON PACKET TELECOMMAND: INPE PROPOSAL TO CCSDS/PANEL 1

- JUNE, 1983 -

THE CONTENTS OF THIS PROPOSAL ARE TO BE PRESENTED IN THE CONSULTATIVE COMMITTEE ON SPACE DATA SYSTEMS - CCSDS PANEL 1 MEETING ON TELEMETRY, TRACKING AND TELECOMMAND - TTC, TO BE HELD AT ESOC, DARMSTADT, WEST GERMANY, JULY 4TH THROUGH JULY 8TH, 1983.

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RATIONALE OF THE PROPOSAL

1. EXTENSION OF THE CONCEPTS ON PACKET TELEMETRY, AS PROPOSED BY THE NEWG RED BOOKS (A.J. HOOKE AND R.R. STEPHENS, 1982) TO CONCEIVE THE PACKET TELECOMMAND CONCEPTS.

2. ADOPTION OF A SYMMETRY PRINCIPLE IN THE DATA FORMATS AT TRANSFER FRAME AND SOURCE PACKET AND SEGMENT LEVELS, WHICH COULD BE EQUALLY USED BY TELEMETRY AND TELECOMMAND DATA, AS WELL.

3. THE SYMMETRY PRINCIPLE WOULD ENABLE, FOR INSTANCE, A SPACECRAFT AND ITS MISSION CONTROL CENTER TO BEHAVE AS SIMILAR END-TO-END PHYSICAL ENTITIES, TO SOME EXTENT, CONCERNING DATA COMMUNICATIONS.

4. THE SYMMETRY CONCEPT, INSPIRED ON THE ISO/OS REF. MODEL, WOULD OFFER THE POSSIBILITY OF CONSIDERING SIMILAR TREATMENT OF DATA, IN BOTH ENDS, AT:

   4.1. TRANSPORT LEVEL, WITH THE USE OF THE TRANSFER FRAME CONCEPT;

   4.2. UPPER (SESSION AND/OR PRESENTATION AND/OR APPLICATION) LEVELS, WITH THE USE OF THE SOURCE PACKET AND SEGMENT CONCEPTS.

5. THE PROPOSED CONCEPT OF SYMMETRY IN PACKET TELEMETRY AND PACKET TELECOMMAND WOULD ALSO ENABLE THE EXTENSION OF THEIR APPLICATIONS BETWEEN ANY TWO HOSTING ENTITIES OF A SPACE AGENCY NETWORK. IN THIS SENSE, PACKET TELEMETRY AND PACKET TELECOMMAND COULD BE EXCHANGED NOT ONLY BETWEEN A SPACECRAFT AND ITS MISSION CONTROL CENTER BUT, FOR INSTANCE, BETWEEN TWO SPACECRAFTS AS WELL.

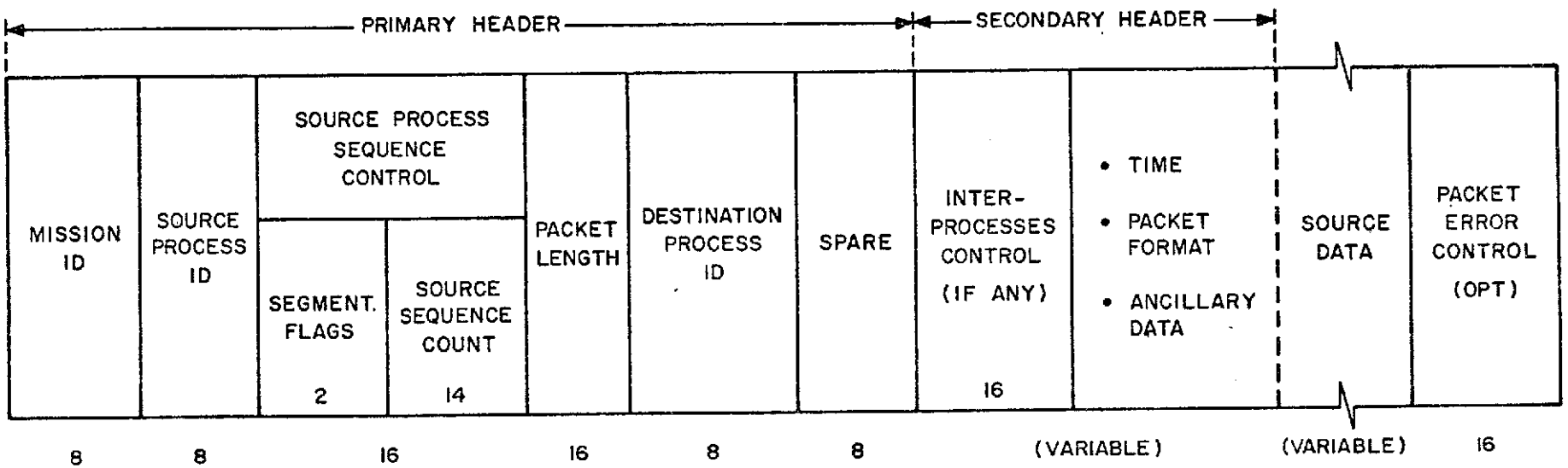
THE SYMMETRY PRINCIPLE PROPOSED FOR PACKET TELEMETRY AND TELECOMMAND IS BASED ON THE POSSIBILITY OF HAVING END-TO-END PROCESSES RUNNING IN SOURCE AND DESTINATION ENVIRONMENTS (SPACECRAFT-TO-SPACECRAFT, CONTROL CENTER TO/FROM SPACECRAFT, ETC.). WITH THIS CONCEPT, THE NOTION OF TELEMETRY AND TELECOMMAND WOULD NOT BE RESTRICTED TO SPACE-TO/FROM-GROUND END-TO-END COMMUNICATION, ONLY. IN ADDITION, SPACE-TO-SPACE AND GROUND-TO-GROUND PHYSICAL ENTITIES COULD EMPLOY THE SAME CONCEPT, AS LONG AS THEY HAVE DATA ACQUISITION AND CONTROL TO BE EXECUTED BETWEEN END-TO-END PROCESSES. IT IS ALSO BELIEVED THAT A MORE UNIFORM TREATMENT OF DATA, WITH SPECIAL IMPLICATIONS IN THE SOFTWARE, DOCUMENTATION AND PORTABILITY WOULD BE ACHIEVED WITH THESE CONCEPTS.

THE BASIC SYMMETRY CONCEPTS PROPOSED FOR PACKET TELECOMMAND AND PACKET TELEMETRY BY INPE, WOULD BE INCORPORATED TO THE (SO FAR) PROPOSED NEWG CONCEPTS ON PACKET TELEMETRY (A.J. HOOKE AND R.R. STEPHENS, AS OF 1982) BY MEANS OF THE FOLLOWING MODIFIED VERSIONS OF THE (ORIGINAL) TRANSFER FRAME AND SOURCE PACKET AND SEGMENT FORMATS.

WITH RESPECT TO THE SOURCE PACKET AND SEGMENT FORMATS, THE INPE PROPOSAL REPRESENTED IN FIGURE 1 SUGGESTS THE DEFINITION OF THREE DIFFERENT ITEMS FOR THE 1982 NEWG

PROPOSED FORMAT FOR PACKET TELEMETRY: 1) REDEFINITION OF THE SOURCE ID FIELD (8 BITS) BY THE NAME OF SOURCE PROCESS ID; 2) INCLUSION OF AN EIGHT BIT DATA FIELD, AFTER THE PACKET LENGTH FIELD IN THE PRIMARY HEADER, DEFINED AS DESTINATION PROCESS ID, FOLLOWED BY AN EIGHT BIT SPARE FIELD, TO COMPLY WITH THE SIXTEEN BIT LONG WORD ORIENTED FORMAT; 3) DEFINITION OF A SIXTEEN BIT LONG WORD FOR INTERPROCESSES CONTROL, TO INITIATE THE SECONDARY HEADER. THE NEED FOR SESSION, PRESENTATION AND APPLICATION BETWEEN END-TO-END PROCESSES WOULD BE PROVIDED BY THE COMBINATION OF THE THREE PROPOSED FORMAT DEFINITIONS, WITH THE OTHER ALREADY DEFINED FEATURES PROPOSED BY NEWG FOR PACKET TELEMETRY. HOWEVER, THE PROPOSED SYMMETRY CONCEPT FOR COMMUNICATION IS COMPLETE, IN THIS CASE, ONLY IF THE SAME MODIFIED FORMAT IS EQUALLY ADOPTED FOR TELEMETRY AND TELECOMMAND, AS WELL.

THE MODIFICATION PROPOSED FOR THE NEWG (AS OF 1982) TRANSFER FRAME HEADER, IN ORDER TO COMPLY WITH THE CONSIDERED SYMMETRY CONCEPT, IS REPRESENTED IN FIGURE 2. IT CONTAINS THE REDEFINITION OF THE FRAME IDENTIFICATION FIELD, CONTAINING TWO SIXTEEN BIT (INSTEAD OF ONLY ONE AS PROPOSED BY NEWG) WORDS. THE FIRST SIXTEEN BIT WORD WOULD CONTAIN A TWELVE BIT SOURCE ID FIELD, FOLLOWED BY A TWO BIT SOURCE LINK ID. THE SECOND SIXTEEN BIT WORD WOULD CONTAIN A TWELVE BIT DESTINATION ID, FOLLOWED BY A TWO BIT DESTINATION LINK ID.



SOURCE PROCESS ID: DEFINES THE PROCESS THAT CREATES THE PACKET

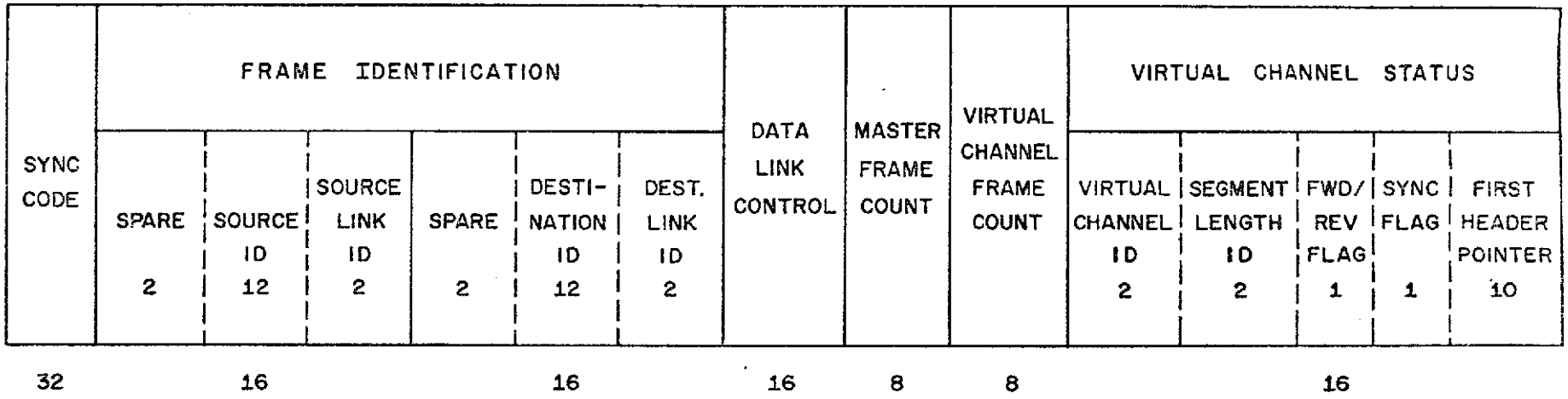
DESTINATION PROCESS ID: DEFINES THE PROCESS THAT RECEIVES THE PACKET

INTERPROCESSES CONTROL: DEFINES THE CONTROL BETWEEN THE TWO PROCESSES IN COMMUNICATION, IF NEEDED. OTHERWISE IT WOULD NOT OPERATE.

OBSERVATIONS:

1) THE PRIMARY HEADER WOULD CONTAIN 64 BITS INSTEAD OF THE 48 BITS, AS PROPOSED IN THE NEWG RED BOOK.
2) THE SECONDARY HEADER WOULD BE VARIABLE, BUT WOULD NECESSARILY BEGIN WITH A 16 BIT INTERPROCESS CONTROL WORD.
3) ALL OTHER DATA FIELDS WOULD OBSERVE THE DEFINITIONS PROPOSED IN THE NEWG RED BOOKS (AS OF 1982).

FIGURE 1 - PROPOSED SOURCE PACKET AND SEGMENT FORMAT FOR PACKET TELEMETRY AND PACKET TELECOMMAND



SOURCE: COULD BE A S/C, MISSION CONTROL CENTER, OR OTHER.

DESTINATION: SHOULD BE A COMPLEMENTARY ENTITY TO THE SOURCE, NAMELY, A MISSION CONTROL CENTER, S/C, OR OTHER.

OBS.: ALL OTHER DATA FIELDS OF THE TRANSFER FRAME WOULD HAVE THE SAME DEFINITION AS GIVEN IN THE NEWG RED BOOK (AS OF 1982). HOWEVER, THE FRAME HEADER WOULD HAVE A (MANDATORY) LENGTH OF 106 BITS, INSTEAD OF 90, AS PROPOSED IN THE NEWG RED BOOKS.

FIGURE 2 - PROPOSED TRANSFER FRAME HEADER FOR PACKET TELEMETRY AND TELECOMMAND

BIBLIOGRAPHY

A.J. HOOKE, TECHNICAL OVERVIEW OF STANDARD PACKET TELEMETRY, NASA/JPL, SPACE-TO-GROUND SEGMENT SESSION, INTERNATIONAL WORKSHOP ON SPACE DATA SYSTEMS, WASHINGTON DC, USA, JANUARY 19-21, 1982.

R.R. STEPHENS, NASA/ESA WORKING GROUP-NEWG, GUIDELINE FOR DATA COMMUNICATIONS STANDARDS: PACKET TELEMETRY, PROCEEDINGS OF INWSDS, WASHINGTON DC, USA, JAN. 1982.

R.R. STEPHENS, PROCEEDINGS OF CCSDS-1, TOULOUSE, FRANCE, OCT. 1982.