Data-processing and news-production systems of Bulgarian National Television

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Bulgarian National Television is currently implementing an integrated data-processing system which operates on three hierarchical levels. Three large databases for mass use are maintained at the first (i.e. highest) level. At the second level, databases for local collective use are grouped together, and the third hierarchical level generates databases for personal use.

Another major project at the production centre in Sofia is the development and introduction of an electronic news-production system, linked to the 3-level data-processing system.

The first part of the article describes the architecture of the 3-level data-processing system. The major characteristics of the electronic news-production system are then described in the second part.

1. Data-processing system

Studies made by Bulgarian National Television (BNT) in 1993 revealed that the automated processing of data in its television production centre took place at three hierarchical levels [1]. Based on these studies, BNT is currently installing a new 3-level data-processing system at its production centre in Sofia.

1.1. Types of database

With reference to *Table 1*, the highest hierarchical level – *Level 1* – supports three huge databases for mass use. These are:

– $DB_{1,1}$

– $DB_{1,2}$

– $DB_{1,3}$

Hierarchical level	Usage	Database	Main database function
1	Mass use	$DB_{1,1}$	Production
		$DB_{1,2}$	Production control
		$DB_{1,3}$	Administrative management
2	Local collective use	$DB_{2,1(1,2,3)}$	Generation of databases at *Level 1*
		$DB_{2,2(1,2,3)}$	Collective use of databases at *Level 1*
3	Personal use	Various data files	Generation and/or personal use of databases at *Level 2*

Table 1
Database functions
at the three
hierarchical levels.

The next level down, *Level 2,* supports two types of database:

– $DB_{2,1,(1,2,3)}$

– $DB_{2,2,(1,2,3)}$

The databases at *Level 3* consist of processed and stored data files which relate to the generation and/or personal use of databases at hierarchical Level 2.

■ *1.1.1.   Databases at* Level 2

Typical Level-2 databases of type $DB_{2,1}$ are shown in *Table 2*. Each database at this level is classified by a 4-number subscript – $DB_{a,b,c,d}$ – where a, b, c and d take on the following values:

a = *2* (the hierarchical level of the current database);

b = *1* (if the main function of the current database is to generate databases at Level 1) or *2* (if the main function of the current database is to provide access to databases at Level 1);

c = *1*, *2* or *3* (depending on the main function of the Level-1 database to which the current database is linked (see *Table 1*));

d = a serial number given to each individual database within a given classification.

Level-2 databases of type $DB_{2,2,(1,2, ...,n)}$ serve the production departments (e.g. editing, technical). One particular database at this level is $DB_{2,2,news}$ which serves the department of television news production and transmission. The new Electronic Newsroom, described in *Section 2*, will make full use of this database in due course.

■ **1.2.   Previous computer system**

Until the end of 1994, distributed data processing was only carried out at hierarchical Levels 2 and 3. It was handled by six PC LAN Ethernet systems, using Novell Netware 3.12 software, supporting the following databases (see *Table 2*):
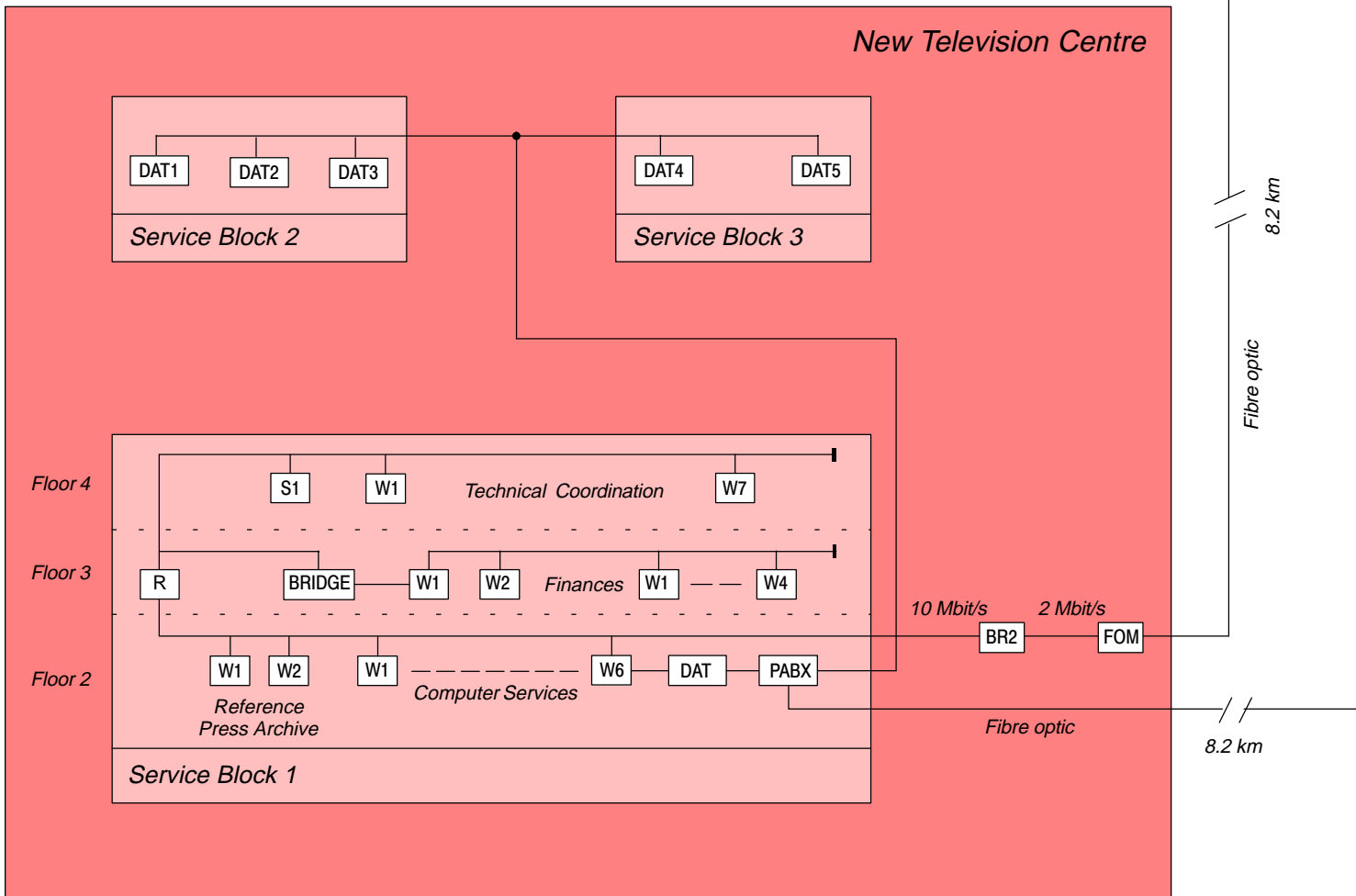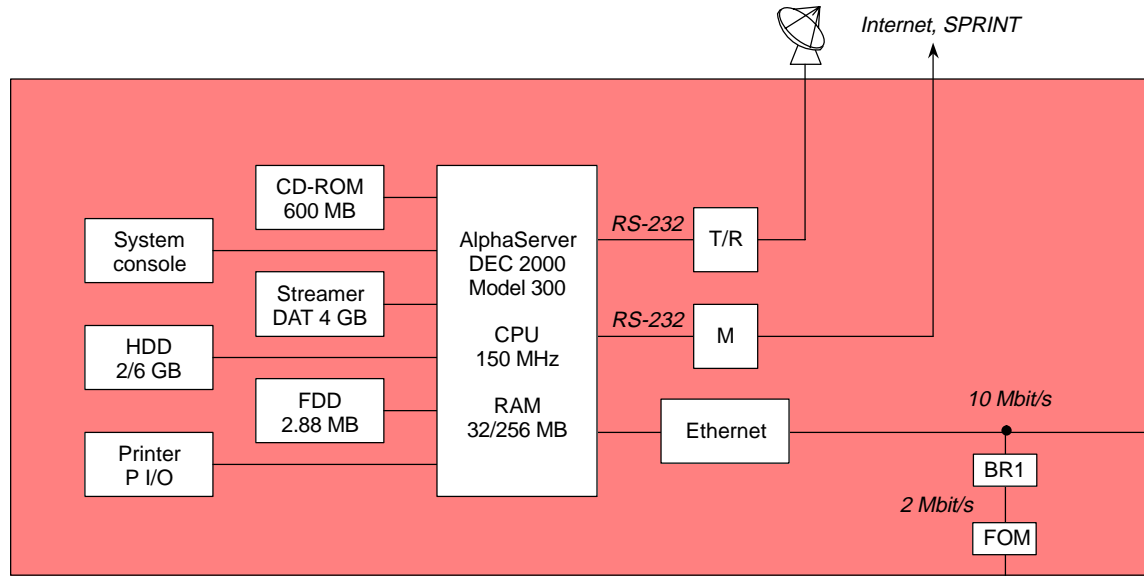
– $DB_{2,1,1,1}$

– $DB_{2,1,1,2}$

– $DB_{2,1,2,2}$

Level-1 usage	Level-2 database	Function of Level-2 database
Production	$DB_{2,1,1,1}$	Incoming and newly-produced television objects and events
	$DB_{2,1,1,2}$	Television (audio and video) archive
	$DB_{2,1,1,3}$	Reference and library archive
Production control	$DB_{2,1,2,1}$	Planning of television programmes and events
	$DB_{2,1,2,2}$	Planning/distribution of technical, staffing and financial resources for the production of television objects and events
	$DB_{2,1,2,3}$	Sociological and audience research data
Administrative management	$DB_{2,1,3,1}$	Management
	$DB_{2,1,3,2}$	Finances
	$DB_{2,1,3,3}$	Staff, work performed and remuneration
	$DB_{2,1,3,4}$	Marketing and sales

Table 2
Typical Level-2
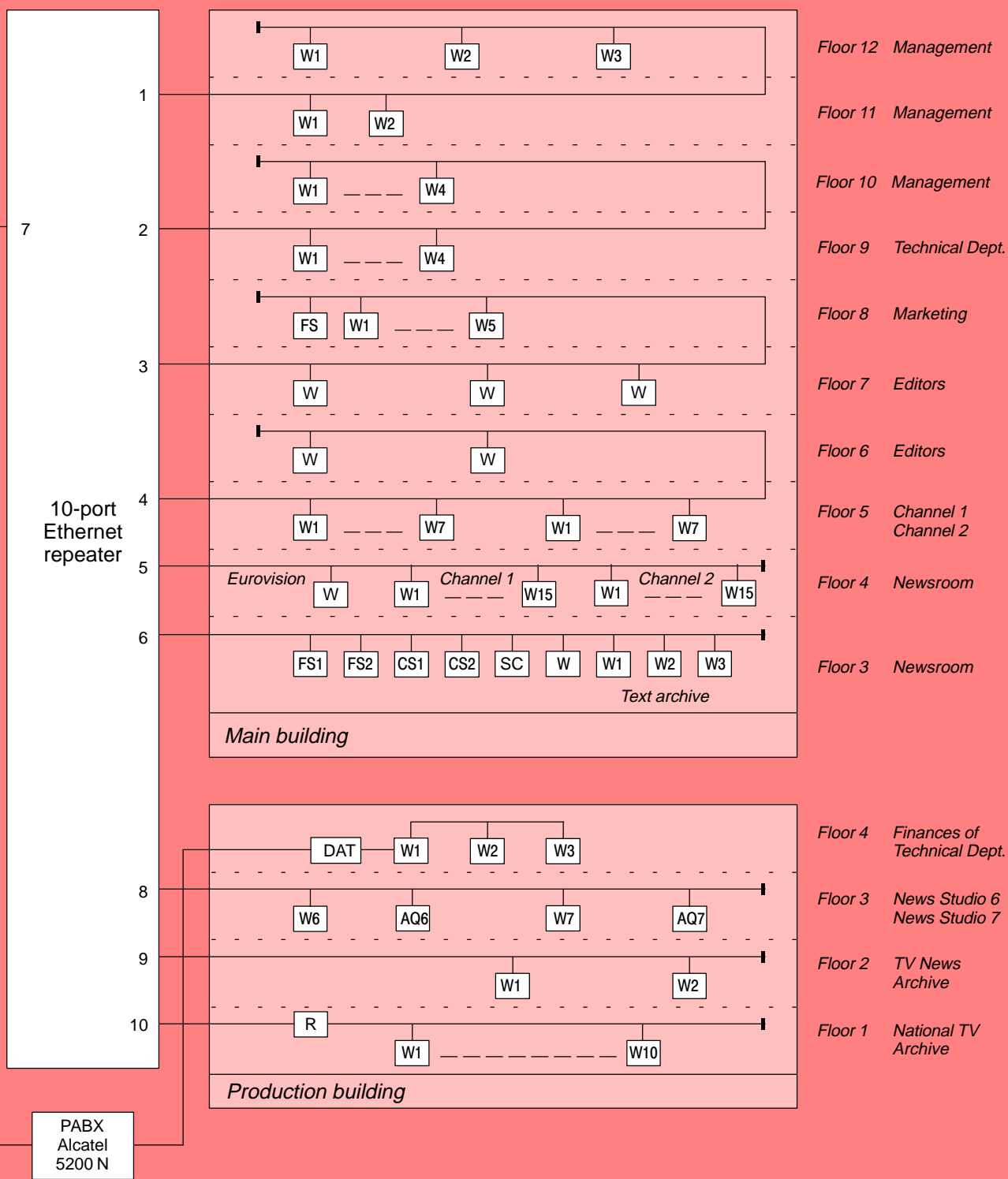databases of
type $DB_{2,1}$.

Figure 1
Physical level
(OSI Level 2) of
the BNT data-
processing system.

Internet, SPRINT

CD-ROM
600 MB

System
console

Streamer
DAT 4 GB

HDD
2/6 GB

FDD
2.88 MB

Printer
P I/O

AlphaServer
DEC 2000
Model 300

CPU
150 MHz

RAM
32/256 MB

RS-232

RS-232

T/R

M

Ethernet

10 Mbit/s

BR1

2 Mbit/s

FOM

New Television Centre

DAT1   DAT2   DAT3

Service Block 2

DAT4   DAT5

Service Block 3

8.2 km

Fibre optic

Floor 4

S1   W1   Technical Coordination   W7

Floor 3

R   BRIDGE   W1   W2   Finances   W1 — — W4

Floor 2

W1   W2   W1   — — — — — —   W6   DAT   PABX

Reference
Press Archive

Computer Services

Service Block 1

10 Mbit/s   2 Mbit/s

BR2   FOM

Fibre optic

8.2 km

Floor 12   Management

Floor 11   Management

Floor 10   Management

Floor 9   Technical Dept.

Floor 8   Marketing

Floor 7   Editors

Floor 6   Editors

Floor 5   Channel 1
Channel 2

Floor 4   Newsroom

Floor 3   Newsroom

W1 W2 W3

W1 W2

W1 — — — W4

W1 — — — W4

FS W1 — — — W5

W W W

W W

W1 — — — W7   W1 — — — W7

Eurovision   W   W1 *Channel 1* — — — W15   W1 *Channel 2* — — — W15

FS1 FS2 CS1 CS2 SC W W1 W2 W3

Text archive

Main building

7

10-port
Ethernet
repeater

1
2
3
4
5
6

Floor 4   Finances of
Technical Dept.

Floor 3   News Studio 6
News Studio 7

Floor 2   TV News
Archive

Floor 1   National TV
Archive

DAT W1 W2 W3

W6 AQ6 W7 AQ7

W1 W2

R
W1 — — — — — — W10

Production building

8
9
10

PABX
Alcatel
5200 N

Key:

AQ	=	Autocue prompter	FOM	=	Fibre-optic modem	R	=	Repeater
BR	=	Data bridge	FS	=	File server	SC	=	System console
CS	=	Communication server	M	=	Modem	T/R	=	Transmit/receive
DAT	=	Data module PABX	PS	=	Print server	W	=	Workstation

– $DB_{2,1,3,2}$

– $DB_{2,1,3,4}$

– $DB_{2,2,news}$

Additionally, there were many stand-alone personal computers, which supported the other databases. These included over 150 PCs (of types PS/2-486DX2, PS/1-486DX and Pentium) working under DOS 5.0 and Windows 3.1. software.

Client access to the various databases was handled within separate local networks via independent workstations. The application software was developed jointly by specialists from BNT (using DBMS *ISIS, CLIPPER*) and from Bulgarian companies (Paraflow, Microcomplex) working to a BNT specification.

Data exchange between the local networks and the independent workstations was extremely limited. It was handled mostly via floppy disks, backup tapes, paper carriers and by partially using the channels of the Alcatel digital telephone system of BNT. This arrangement did not allow

Figure 2
General view of the BNT electronic newsroom.

individual workstations to have direct access to the separate databases.

■ 1.3. New computer system

1995 witnessed a significant step forward in the development of the data processing system of BNT. With the participation of the Bulgarian firm Prosoft, a BNT project to integrate the existing local networks and independent workstations has now been completed. It is based on a high-capacity server, running the UNIX operating system, which controls the data processing at hierarchical Level 1 and the coordination and data exchange between the sub-systems at the lower hierarchical levels.

■ 1.3.1. Hardware

The first hierarchical level is implemented on a DEC AXP2000 server, model 300 of the ALPHA series. A UNIX operating system coordinates the work of all the PC LANs and computers within the integrated system, and provides for communication with all external systems. At this stage, the DEC server has the following characteristics:

Figure 2
General view of the BNT electronic newsroom.

CPU clock speed:	150 MHz
RAM:	64 (256) MB
CD-ROM	650 MB
Hard disk	2 (6) GB
DAT tape streamer	4 GB

The second and the third hierarchical levels are implemented by six Ethernet PC LANs and by PS/2-486DX2, PS/1-486DX and Pentium computers.

A permanent network cable system, including all necessary multi- and two-port repeaters, is installed in each building of the BNT production centre in Sofia. As shown in *Fig.1*, the distance between the old Television Centre (which is still in use) and the new Television Centre is 8.2 km. The sub-systems in both centres are connected via optical-fibre cable, equipped with modems (2048 kbits/s) and special bridges which have no compression. Channels of the existing digital telephone system are also used.

■ 1.3.2. Software

The integrated computer system uses the following software:

– OSF/1 AXP

– ORACLE for DEC OSF/1 and for MS Windows

– FTP software, PC/TCP

– LAN software, Novell Netware 3.12

– DOS 5.0.

The application software is still under development and includes:

– stage-by-stage adaptation of the existing application software into the UNIX/ORACLE environment;

– implementation of the new application software into the UNIX/ORACLE environment;

– implementation of the communication software into the UNIX/ORACLE environment.

■ 1.3.3. Data exchange

The data exchange between the different local networks and the independent workstations is handled by the communication resources of the integrated system, using:

– communal access databases;

– direct data exchange.

At each workstation, users are given access to all the data necessary to carry out their activities. Internal electronic mail is also available through the system.

■ 1.3.4. External communication

The system already has specialized external channels for journalistic information exchange.

It is projected that the system will be connected in due course to the international computer networks (Internet, SPRINT, etc.).

■ 1.4. Current progress

The system has been designed to handle future multimedia data exchanges, and Asynchronous Transfer Mode (ATM) operation. It will also be compatible with future tapeless storage technology.

■ 2. Electronic newsroom

As part of the integration of data-processing activities within Bulgarian National Television, a study was made of the data-processing system that would be required to produce and broadcast television news [2]. Arising from this study, BNT has installed an electronic newsroom system (see the photograph in *Fig. 2*).

■ 2.1. Production sub-systems

As shown in *Fig. 3*, the production and transmission of television news is handled by six Production sub-systems:

Sub-system 1 enables the incoming text data from DB1 to be analyzed, and then to be archived in DB2.

Sub-system 2 generates text information for journalists, based on text data taken from DB1, DB2 and DB3, in conjunction with incoming, and locally-produced, video and audio objects[1]. This information is used by the journalists to create a "subject description" of the locally-produced audio/video objects (which will be stored in DB4) and to initiate requests for the production of new video objects (DB5).

Sub-system 3 produces primary video and audio objects, based on text data from DB4, DB5 and DB6.

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1. Throughout this article, a stored segment (sequence or item) of audio or video is referred to as an "object".
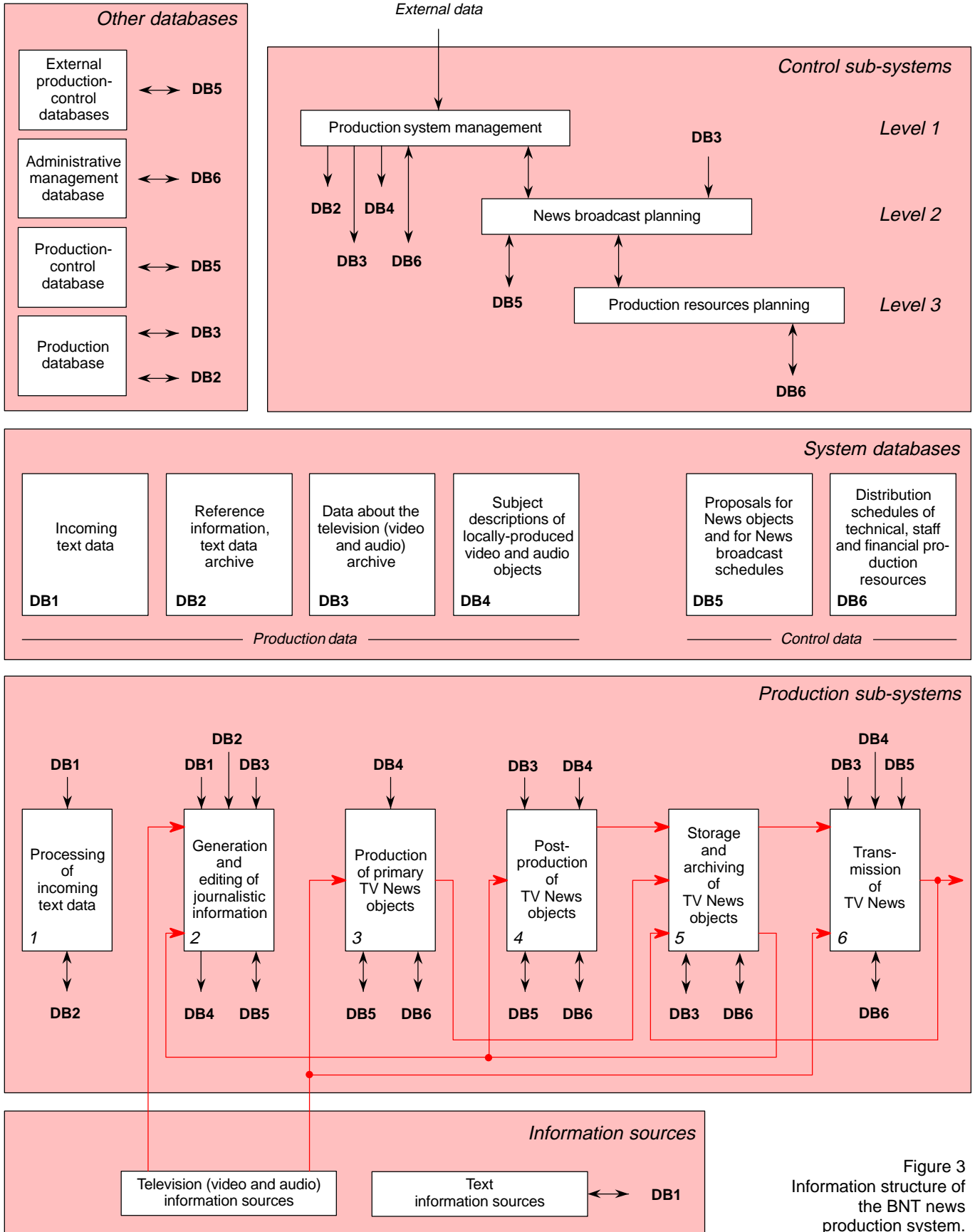
Figure 3
Information structure of
the BNT news
production system.

Sub-system 4 produces ready-to-broadcast television objects. These are based on locally-produced primary video and audio objects, incoming video and audio objects, text data which describes the aforementioned video and audio objects (DB3 and DB4), and production-control text data (DB5 and DB6).

Sub-system 5 oversees the archiving of completed video and audio objects. It also generates (in DB3) data which relates to those objects.

Sub-system 6 is responsible for the transmission of TV News programmes. The stored video and audio objects are sequentially connected to the BNT News transmission network in real time, based on the text data stored in DB3, DB4, DB5 and DB6.

In general, the news production environment has a multi-media character. *Sub-systems 2, 3, 4, 5* and *6* process text data, as well as video and/or audio news objects. A significant part of the news processing operation is thus carried out by multi-media technical modules in the studio [3].

The routeing of television (video and/or audio) signals between the various sub-systems is indicated on *Fig. 3* by red-coloured lines.

■ 2.2. Control sub-systems

The control of the television news production and transmission process has a hierarchical nature. It is handled in four levels.

Long-term and mid-term decisions, relating to the Control sub-systems, are taken at the highest hierarchical level, Level 1. At Level 2 the planning of television news is handled. At Level 3, the technical, staff and financial resources which are necessary for the completion of each stage of the production process are planned and distributed.

*In 1967, **Angel Deliysky** graduated with an M.Sc. in Electrical Engineering (Electronics and Computers) from the Technical University of Sofia. That year, he joined the Technical Department of Bulgarian National Television as a maintenance engineer and eventually became head of the group. In 1972, he became a departmental manager and went on to become Manager of TV Broadcast Automation at Bulgarian National Television in 1981. He still holds that post today.*

In 1979, under the auspices of the ITU, Mr Deliysky received specialist training in the automation of TV broadcast production, at the premises of various TV broadcast companies in West Germany, Austria and Switzerland. Two years later, he received further training in this field from Bosch-Fernseh in West Germany. In 1985, he obtained a Ph.D. in Electrical Engineering (Automation of TV Broadcast Production) in Sofia.

Mr. Deliysky was Head of Study Group 5 in the OIRT until its amalgamation with the EBU in January 1994.
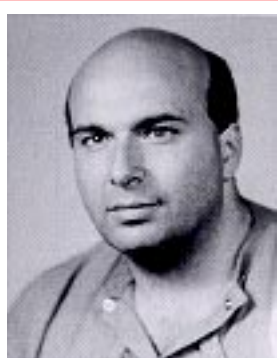
***Ivo Baberkov** is a graduate of Sofia State University, Department of Mathematics. Between 1984 and 1985, he carried out R&D work on computer systems in the field of metallurgical engineering, before joining the Institute "Interprogramma" in Sofia as a programmer in the domain of 3-D modelling and CAD/CAM systems.*
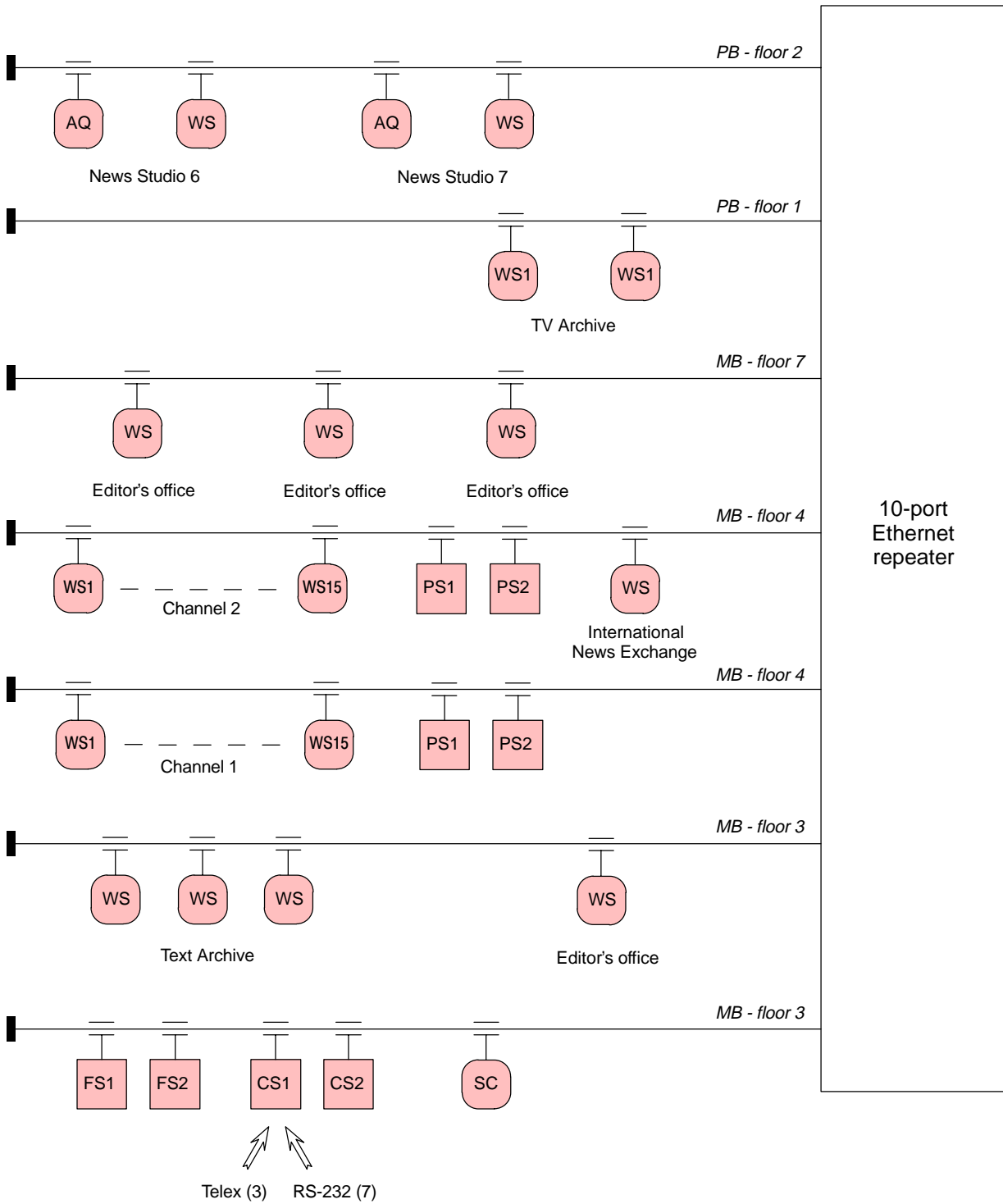
In 1987, Mr Baberkov joined the Technical Department of Bulgarian National Television as a system programmer. Since then he has worked on televison data processing, PCs and LAN-Novell networking systems.

***Bojidar Simeonov** graduated with an M.Sc. in Electronics from the Technical University of Sofia in 1967. Over the next two years, he worked for the Bulgarian Radioelectronic Institute as an R&D engineer on the automation of manufacturing processes, then moved on to the Central Institute for Computing Techniques as a designer of 12-bit minicomputers and systems.*

Between 1975 and 1978, Mr Simeonov worked on the computer-automation of scientific experiments in the Biophysics Laboratory of the Bulgarian Academy of Sciences. In 1979, he joined the Central Institute for Computing Techniques and Technologies as a senior research engineer and designer of 16- and 32-bit minicomputers. While he was here, Mr Simeonov obtained a Ph.D. in Computer Sciences and, in 1984, became Associate Professor/Senior Research Collaborator in the field of computer systems.

Mr Simeonov joined the Technical Department of Bulgarian National Television in 1992 where he currently works as a senior research engineer in the field of TV computer systems.

News Studio 6   News Studio 7   *PB - floor 2*

PB - floor 1

TV Archive

MB - floor 7

Editor's office   Editor's office   Editor's office

MB - floor 4

Channel 2   International News Exchange

MB - floor 4

Channel 1

MB - floor 3

Text Archive   Editor's office

MB - floor 3

Telex (3)   RS-232 (7)

10-port Ethernet repeater

Key:
AQ = Autocue prompter
CS = Communication server
FS = File server
MB = main building

PB = Production building
PS = Print server
SC = System console
WS = Workstation

Figure 4
Physical level (OSI Level 2)
of the BNT Newsroom LAN.

The control of the studio equipment in every technical module is made at the lowest hierarchical level, Level 4.

2.3. Data exchange

All data exchanges within the electronic news environment are realized by the production and the control databases. As shown on *Fig. 3*, the System databases also exchange data with other databases of BNT, described in *Section 1*, as well as with external production-control databases.

At its current stage of development, the BNT News Production system includes all the text data processes described above. Each day, using the system, BNT produces ten news broadcasts for its Channel 1 and Channel 2 television networks.

In particular, the following operations can be carried out from any of the forty-plus computer workstations connected to the system:

– access to news agency data, via seven information channels (using RS-232/telex);

– access to data from the news press and to data concerning the international exchange of television news;

– access to data in the BNT television archives about produced television objects and their storage media;

– access to data concerning the TV News broadcast schedule and the production resources distribution schedule;

– text processing and generation of text files;

– text input to the Autocue prompters of the Channel 1 and Channel 2 news studios;

– transmission of data concerning the international news exchange.

2.4. Technical implementation

The technical implementation of the system is similar to that described in [4] and [5]. It is based on a PC LAN Ethernet which uses Novell Netware 3.12 for up to 50 workstations, DOS 5.0 and Windows 3.1 software.

The system (see *Fig. 4)*, also includes:

– a fully-redundant file server, FS1 (FS2);

– a fully-redundant communication server, CS1 (CS2);

– a system console, SC;

– a 10-port Ethernet repeater;

– Autocue prompters, AQ;

– over 40 workstations, WS, as well as PC-notebook workstations, which are located in two adjacent buildings – the Main Building (MB) and the Production Building (PB).

The file server is based on PS/2-486DX2 PCs, the communication server on PS/1-486DX computers, and the workstations and prompters on 486DX and Pentium PCs.

CD read/write discs are used for archiving purposes and CD-ROMs for data input.

The application software has been developed by specialists from BNT in collaboration with Bulgarian software companies. It is based completely on the project decisions of BNT.

2.5. Current progress

The System is still under development. During the current year, as well as increasing the number of workstations, an integration of the electronic news system with other computer networks and data systems of BNT is in progress.

Bibliography

[1] Deliysky, A.: **An approach to the Automation of Data Processing Processes in TV**
Elektrotechnica and Elektronica, Vol 3-4, Sofia, Bulgaria, pp.1-4, 1993.

[2] Deliysky, A.: **Automating TV News Broadcast Production**
Elektrotechnica and Elektronica, Vol 7-8, Sofia, Bulgaria, pp. 23-27, 1993.

[3] Deliysky, A., Shoylev H.: **Functional Structural Modeling of TV Production Processes**
Elektrotechnica and Elektronica, Vol 5-6, Sofia, Bulgaria, 1993.

[4] Gould M.: **NewsMaker: Mixing It with the Big Boys!**
Broadcast Hardware International, No. 53, pp. 28-32, April 1995.

[5] Long B.: **NewStar: Broadcast Newsroom Automation and the NewStar II Hardware and Software Architecture**
Broadcast Hardware International, No. 53, pp. 32-34, April 1995.