PARALLEL SIMULATION OF FAULT AND FREEFAULT PSEUDO- BOOLEAN SCHEMES

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Запропоновано метод паралельного моделювання справних та несправних сучасних великих електронних приладів.

Digital devices manufactured by the MOS- and CMOS-technologies have some features of operation which complicate their simulation when being represented by the gate level models. The bidirectional character of signals presents no difficulties if healthy devices are under consideration but the fault simulation shows clearly the shortcommings of the conventional gate approach [1-3]. In [3] six shortages of the classical switching circuit theory are pointed out as applied to the analysis of modern VLSI MOS-circuits. The specific character of the MOS-circuit operation may be taken into consideration by simulation at the switching level [1-4] using various modification of Bryant's algorithm [5]. The aim of this work is to speed up the simulation procedures by constructing a parallel simulation algorithm at the switching level which is equivalent to Bryant's algorithm.

Going to the suggested method, note that the input data for the algorithm are, firstly, the description of the circuit having MOS- transistors differing in their high and low resistances, and the nodes characterized by high and low capacitance. For convenience this description is supposed to be equivalent to those in the "esim" language [4]. Secondly, the sequence of input signals is specified. The algorithm fields the signal values at each node of the device as responses to given input actions.

Let {*Z* (*C0*, *C1*), *CX*, (*SC0*, *SC1*), *SCX*, (*W0*, *W1*), *WX*, (*D0*, *D1*), *DX*} be the simplest signal set needed for *n*-MOS-circuit simulation which is ordered in reference to ≤. We use ordinary notations *D*, *W*, *SC* and *C* to describe the forces (controlled, weak, supercharged, and charged) and notation *0*, *1*, *X* to describe the node state [4]. So, for any signal $S = (H, G)$, where $H(G)$ is the force value (state value). A particular place is occupied by the signal $Z = (Z_H, Z_G)$, which is taken as node disconnection.

The signal value at node *v* in the MOS-circuit may be determined as the magnitude of the "strongest" signal among all signals caming to it by all acyclic paths passing through the conducting transistors from the device input nodes and the nodes where the capacity existed initially. There is a simple iterative technique for calculating the node response to the input actions for this rather complicated definition. Let the signal value at $u(\mathrm{val}(u))$ be $S_u = (H_u, G_u)$. For each node *v* a new signal value $S^{(i)}$ is calculated in compliance with joining the previous value *v* and function values $F_{uv}(\mathrm{val}(u))$ associated with the transistor between nodes *u* and *v* for all neighbours *u* of node *v* [4]. The calculations continue until $S^{(i+1)}$ is equal to $S^{(i)}$. Denote $F_{uv}(\mathrm{val}(u))$ as $f(T, R, H_u, G_u)$, where *u* is the node connected directly to *v* through a transistor of the *T* type which has the value *R* at its gate. The function *f* of the signal transformation when the signal is passing through the transistor will be considered later. These iterative calculations give wrong results for some complex circuits. Bryant's algorithm modifies the calculations performed by this calculation scheme, which is a ground for a so-called simple algorithm using the distributive transistor functions *f*. At first we consider the simple algorithm with the distributive transistor transformation functions and then proceed to Bryant's parallel algorithm.

Recall the transformation rules for a signal passing through transistors [2, 4]. First consider the circuits consisting of the *n*-MOS-transistors only. The switching-type *n*-MOS-transistor will be denoted as $T = 1$, while the load-type transistor (put instead of resistor in the MOS-circuits) $T = 0$. Denoting the transistor gate value by *R*, assume that $R = 0$ for the cut-off transistor and $R = 1$ for the conducting transistor. The first rule states that for the cut-off transistor, its source and drain have no effect on each other, i. e. are disconnected, and $f(T, R, H, G) = Z$ at $R = 0$, $T = 1$. It follows from the second rule that $f(T, R, H, G) = (H, G)$ at $T = 1$ and $R = 1$ which means full signal transition through the conducting switching transistor. The third rule defines the conducting load transistor operation ($T = 0$). It may be written in the form $f(T, R, H, G) = (W, G)$ at $H = D$ or as $f\ (T,\ R,\ H,\ G) = (H,\ G)$, otherwise. Extending the transformation rules for signals passing through transistors [4], we can define the transformation function f for the signal $S = (H,\ G)$ passing through the T type transistor with the state signal value R at the gate:

$$f\ (T, R, H, G) = \begin{cases} Z \text{ at } T = 1 \text{ and } R = 0; \\ (H, G) \text{ at } T = 1 \text{ and } R = 1; \\ (H, G) \text{ at } T = 0 \text{ and } H < D; \\ (W, G) \text{ at } T = 0 \text{ and } H = D. \end{cases}$$

Now represent f by the totality of Boolean functions which may be evaluated in parallel for the simple algorithm and Bryant's algorithm. The forms of these functions depend on the force and state value coding. Since the main memory capacity is occupied by the link description, the saving of memory hardly depends at all on the coding type of the force signal or node state. So, in order to raise the simulation speed we assume the following signal coding: $Z = (Z_h, Z_g)$, where $Z_h = (0, 0, 0, 0)$ and $Z_g = (0, 0, 0)$, $D = (1, 0, 0, 0)$, $W = (0, 1, 0, 0)$, $SC = (0, 0, 1, 0)$, $C = (0, 0, 0, 1)$, $X = (1, 0, 0)$, $1 = (0, 1, 0)$ and $0 = (0, 0, 1)$. Let $F = f(T, R, H, G)$, then for the bit components $F = (FH_1, FH_2, FH_3, FH_4, FG_1, FG_2, FG_3)$ for the chosen coding we obtain the following expressions, with the assumption that $R = (R_1, R_2, R_3)$, $H = (H_1, H_2, H_3, H_4)$ and $G = (G_1, G_2, G_3)$. For the node state values

$$FG_1 = G_1 (\ \overline{T} \vee TR_2\ );\ FG_2 = G_2 (\ \overline{T} \vee TR_2\ );$$

$$FG_3 = G_3 (\ \overline{T} \vee TR_2\ ); \qquad (1)$$

while for the force values

$$FH_1 = H_1TR_2; \qquad FH_2 = H_2 (TR_2 \vee \overline{T}\overline{H_1}) \vee \overline{T}\overline{H_1};$$

$$FH_3 = H_3(TR_2 \vee \overline{T}\overline{H_1}\ ); \qquad FH_4 = H_4 (TR_2 \vee \overline{T}\overline{H_1}). \ (2)$$

The simulation of the MOS- and C-MOS-structures poses the need introduce the *p*-MOS-transistor, which implies certain complication of the equation for the transformation function f, because if a large number of transistors are described, bit variables T_1, T_2 used for their coding are needed. Let for the load transistor $T_1 = 0$ (for T_2 -- indifferently); for the *n*-MOS-transistor we have $T_1 = 1$, $T_2 = 1$, and for the *p*-MOS-transistor $T_1 = 1$, $T_2 = 0$. Taking into account that the *p*-MOS-transistor, in the view of the logics, operates as a *n*-MOS-transistor with the inverse gate value, we get the equations similar to (1) and (2) :

$$FG_1 = G_1 T_1 K \vee G_1 \overline{T_1};$$

$$FG_2 = G_2 T_1 K \vee G_2 \overline{T_1};$$

$$FG_3 = G_3 T_1 K \vee G_3 \overline{T_1};$$

$$FH_1 = T_1 H_1 K;$$

$$FH_2 = T_1 H_2 K \vee \overline{T_1}\overline{H_2}H_1 \vee \overline{T_1}H_1;$$

$$FH_3 = T_1 H_3 K \vee \overline{T_1} H_3 \overline{H_1};$$

$$FH_4 = T_1 H_4 K \vee \overline{T_1} H_4 \overline{H_1},$$

where $\oplus$ is the "exclusive-OR" operation and $K = R_2$ $\overline{\oplus T_2}$ For $T_2 =$ (only *n*-MOS-transistors) they pass to (1) and (2).

The types of MOS-circuit fault are depicted in figure 9.5 [6]. The simulation of a circuit with this fault is the simulation with a corresponding structure data.

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SIMULATING THE REMOTE CONTROLS OF THE ELECTRIC NETWORK BY USING THE PROCESS COMPUTER DISTRIBUTION METHOD

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The abstract

Nowadays the electric energy has a very important place, starting from its production,, passing through transport and distribution and finally reaching at the curent user who is the electric energy's consumer, or its client. The article represents an information system used in a central expeditious point, which controls a limited geographical area (a region) of medium and high voltage electric networks and also the work in the "simulation" option of these networks, used for preparing the dispatchers for the unforecasted events that can happen in a power system, events which can lead to the unsteadyness of this system (the lowering of the frequency), with catastrophic consequences for the economy of the region catered by that power system.

INTRODUCTION

The main purpose :

- the operation with maximum efficiency of the plants in conditions of maximum security demanded by the technological process of the electric energy customers;
- the permanent supply of electric energy for the customers in conditions of safety, quality and efficiency ;
- the preparation of the energetic dispatcher's reaction in case of normal or special conditions (damages, etc.) by working in the <<"simulating " events >> mode .

The leading of the systems of the electric networks is realised either in the concise option, either in the distributed option. We use the SCADA concept (Supervisory Control and Data Acquisition), with the next functions :

- generating and updatig the data base : the data base is related to the process , but it's outside the process, situation that allows a quick modification of the structure;
- generate and update the schemes of the electric networks : done with the help of an electric scheme editor , named graphical characters generator ;
- the human-machine interface - it's used the the graphic window technique taken from the Motif medium(for the UNIX operating system) or WINDOWS system ;
- the processing of the events and alarms : Event means any change which happens in the watched system; some events are seen as " alarms" and they must be treated in a special way , because some can be permanents and they will remain in an " alarm list" until the removing of the causes that generated them;
- makes calculation for processing-made as the result of the cyclic or in demand generated events; making some calculus , arithmetic operations on the sizes from power system -voltage, active power , reactive power , energy , power factor;
- make archives of the processing sizes : as a table , curves have on the abscise the times , numeric values written on the schemes of the stations or of the network;
- post mortem (after demarage) rewiev ;
- the stationary regime estimation (calculus): offers a complete solution of the variables of a network;
- analyses the contingents : is quickly establishing the effects that the appearance of some incidents in thje power system has on the safety condition of the power system ; this function is executing in both real and " simulation " modes.;

- the work in the simulation modality the preparation of the energetic dispatcher's reaction in case of normal or special conditions (damages, etc.) by working in the <<"simulating " events >> mode ; allows in any moment to be maked a copy of the process data base, used for study and analise. The process data base can be the one from the moment of the beginning or another one , saved manually by the user .

Hierarchical levels are the following :

- operative commanding centre ;
- transformation station;
- cell (departure)
- transformation point.

The hardware configuration is organised on hierarchical levels :

- the equipment for data acquisition (receiving information's from the process)
- the data's transmission support
- local equipment's for taking over the data's
- the take over system at a central point of command

The software constituent represents a packet of main and application programs, which are organised on processing levels The configuration of the system means the drawing of the monowirelar electric scheme for the remote control of the electric network (junctions, knots = electric station remote controlled STC).

An important information offered by the packet of programs is the existence or the absence of the voltage on a line, bar or equipment.

Because of the real time functioning or of the simulating mode , it's possible to:

- analyse the stability of the network
- optimise the functioning of the network (by commanding in real time the remote controls). .

The high voltage network can be modelled using an multivariable linear system. , show in fig.1

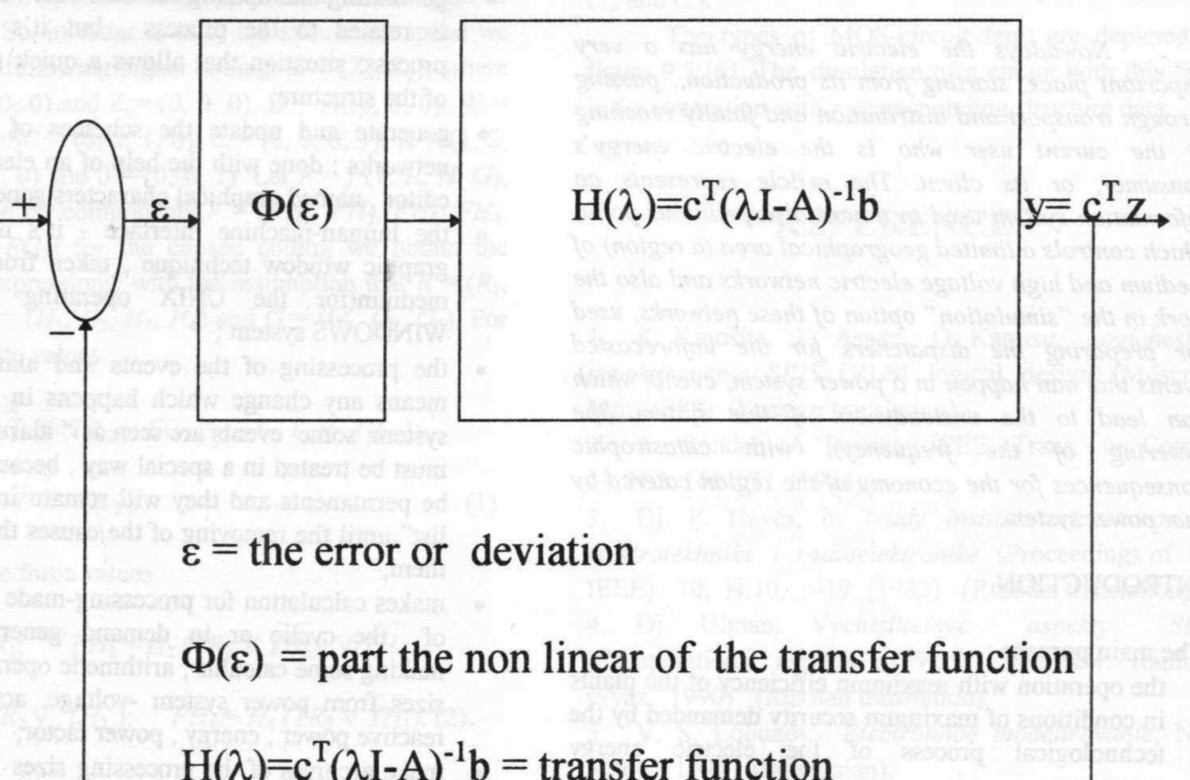

fig.1

Model of high voltage network

The linear part is given by the transfer function

$$H(\lambda)=c^T(\lambda I-A)^{-1}b \quad [1]$$

and the non linear part is given by the transfer function $\Phi(\varepsilon)$. The system can be written this way :

$$\dot{x}=f(x,t,\mu) \text{ whith } x(t_0)=x_0 \quad [2]$$ where :

- **x** is the n-dimensional state vector, made from voltage, actives and reactives powers, power factors, suitable to the all electric knils (electric transformation stations).
- **f** is a vectorial n-dimensional function
- μ is a constant or variable vector

The equation $\dot{x} = f(x,t,\mu)$ has only one solution , $x(t) = \psi(t,t_0,x_0,\mu)$ for an $x(t_0) = x_0$ and $t=t_0$. Then the identity $x(t_0) = \psi(t_0,t_0,x_0,\mu) = x_0$ is verified. Admiting that $x_0=0$ is an unique point for the equations worm form is $f(x,t,\mu)=0$, then the equation $f(x,t,\mu)=0 \Rightarrow f(0,t,\mu)=0$ and in this conditions , the system becomes disturbed.
The passing of the system from an initial state described by the state vector $x_0=x(t_0)$ in another state, $x_1=x(t_1)$ is modeled by the function of Liapunov type, if: for every pozitiv number given , $\varepsilon>0$ (ε arbritary small) it's possible to pick another number $\delta>0$ in such manner as the initial disturbations x_0 (which verify the inequality $|x_0|<\delta$) to determin another disturbed system, given by $x(t)=\psi(t,t_0,x_0,\mu)$ in such way as for every $t>t_0$ is verified the condition $|\psi(t,t_0,x_0,\mu)|^2 < \varepsilon$.

Briefly, for every $\varepsilon>0$, $\exists\ \delta>0$, $|x_0|^2< \delta \Rightarrow |\psi(t,t_0,x_0,\mu)|^2 < \varepsilon$, $\forall\ t>t_0$, then the undisturbed system modeled by $f(0,t,\mu)=0$ is called stable asymptotical in Liapunov way.

THE STAGE OF THE HIGH VOLTAGE NETWORK'S OPTIMISATION

An electric system can be discribed using common differential equations or with partial coefficients, integral equations, in which praises its causative structure by the state, input and output magnitudes :
The system is : $\dot{x}=f(x,u,t)$

$$y=g(x,t) \quad [3]$$ where

- $t \in [t_0,t_1] \subset T \subseteq R$
- **x and f are vectors in R^n representing the state**
- **u represent an input vector field**
- **y represent an output vector field**

$$x \in X \subseteq R^n,$$
$$u \in U \subseteq R^m,$$
$$y \in Y \subseteq R^r \quad [4]$$
$$f : XxUxT \rightarrow R^n,$$
$$g: XxT \rightarrow R^n$$

where x , u , t , y represents areas admitted for **state, input, output, time interval.**
The magnitudes x(0),u(0),.... verify equations following :

$$\dot{x}=f(x,u,t)$$
$$y=g(x,t) \quad [5]$$

where $t \in [t_0,t_1] \subset T \subseteq R$ in the conditions given which determins trajectories or curves **integral** of the system, and we look for an **optim** here.
This optim is given by mathematic model:

$$y=\int_{t_0}^{t} L((x,u(t),t)dt + M(t_0,x_0,t,x) \quad [6]$$

The optimisation is made by the criterion of :

- minimal time
- minimal consumption
- the method of the small test

THE SOFTWARE STRUCTURE OF THE CONTROL TELEGRAMS

In case remote control in real time , the lasting of the on/off impulse is adjusted at the value of 1.2 sec
The comunication networking is distributed and using a model typ with 485.

The structure of information system is show in fig.2 and contents : controllers, modems, traductors, Local Area Network with Personal Computers, monitors, keyboard and others peripherals.

The logical unit for data transfer between the central point and the microcontrols (dedicated Microsystems) is the telegram, made from a variable number of octets. Every telegram has a heading (the support of the useful information). Each octet contains 8 bits, used like this:

- 6 for the support of information
- 1 for recognising
- 1 for parity

The telegrams can also be for :

- **the control and the synchronisation of the communication** (reception confirmation, reception with errors, loosing the touch , time synchronisation).
- **especial ones** :
  - broken (damaged) remote control reception
  - signal buffer (full, empty)
  - send of an initialisation bloc
  - general control
  - state demanding cells
  - automatizations positions demanded

The schemes of the high voltage network is showing in fig.3 where :
LEA110KV TESTARE1 = line electric aerial
LEA110KV TESTARE2 = line electric aerial
Sl1 , Sl2 = separators lineas
IH1, IH2 = breakers of high voltage
TR1, TR2 = transformers high / mean voltage
S21,S22,S23,S24,S25=separators block 2
S11,S12,S13,S14,S15= separators block 1
Sb1,Sb2=separatores terminal transformers
CTV = couple transversale
Bc1,Bc2=battery capacitors
IM1,ICTV,IM2,IBC1,IBC2=breakers of mean voltage

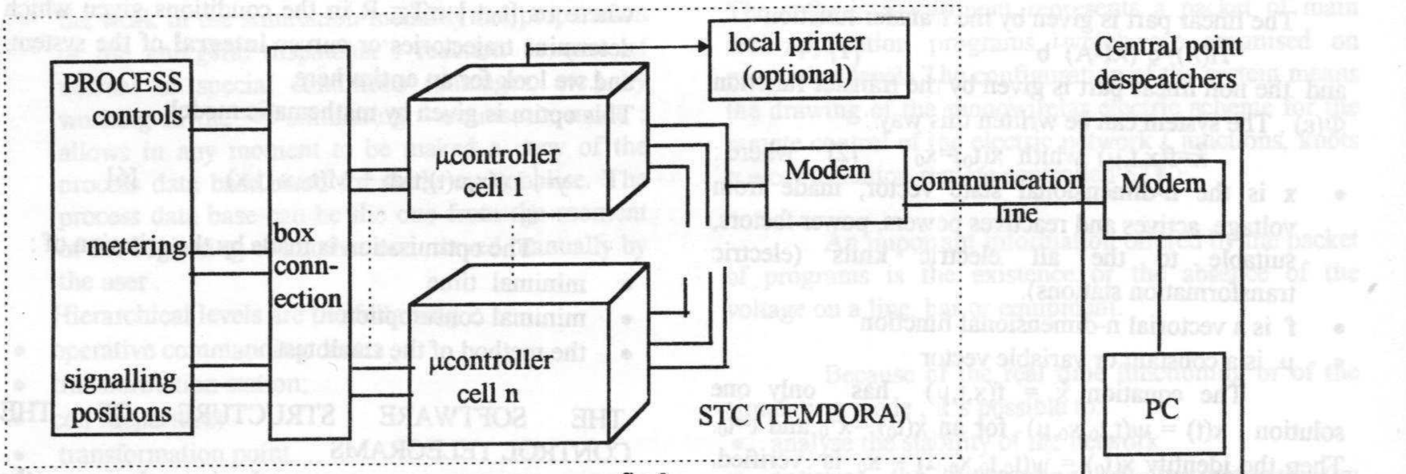

fig.2

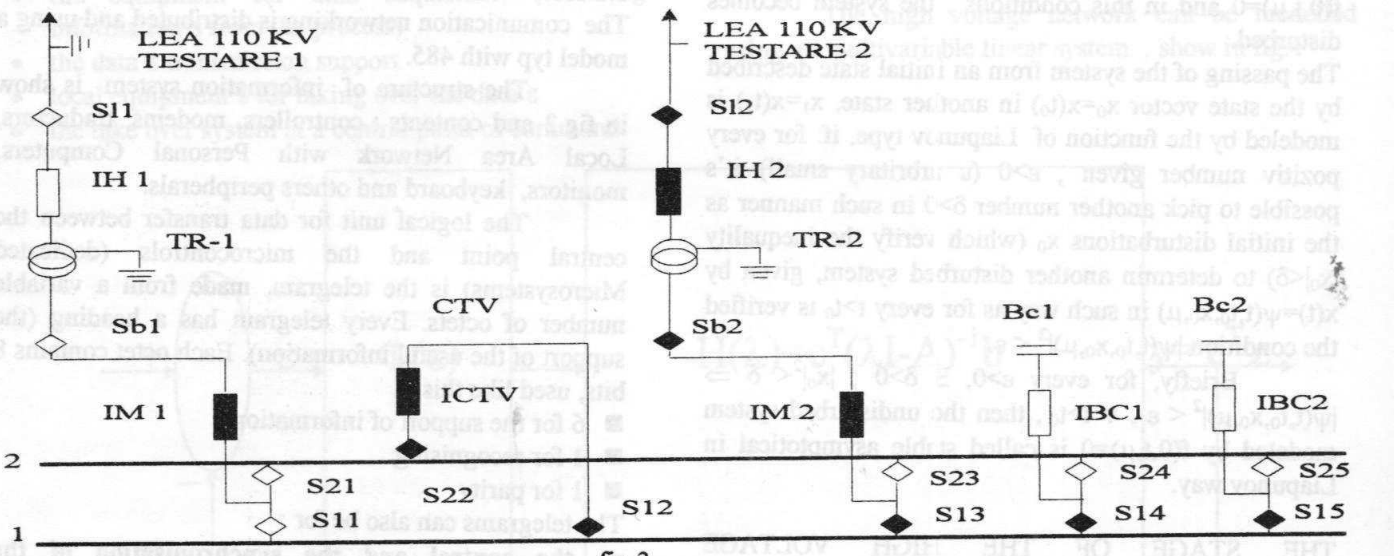

fig.3

CONCLUSIONS

When the dispatcher work in the simulating method, he has in front of him a monowirelar electric scheme of an STC, which is choosed from a list of STC, wich represents a regional geographical area of High and Medium Voltage electric networks. By simulating manoeuvres (on/off switches or pif /sdf automatizations), the dispatcher will notice the consequences appeared as a result of the execution of that remote control. The electric scheme changes its colour, the parts which are under vopltage become lighted and modifies theier colour. The dispatcher is able now to give a forecast of the future evolution of the electric network, supervised and controled by the process computers.

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SOME ASPECTS OF IMPLEMENTING MULTIMEDIA SERVICES ON NETWORKS

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ABSTRACT

Some aspects of implementing multimedia services using LAN futures are studied with focus on video/audio information transmission. Consideration on compression methods and comparative results are shown. The data flow parameters are estimated for different casses. Using of video-teleconferencing systems for different purposes were took into account.

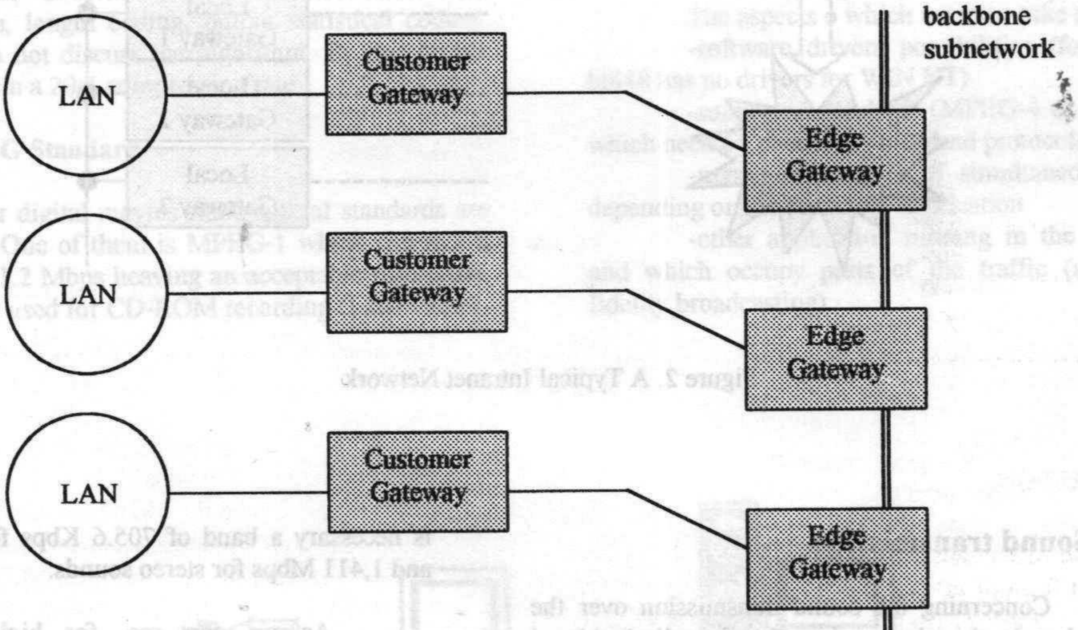

Figure 1. LAN Interconnection

1. INTRODUCTION

Using the Intranet futures it is possible to implement some interesting application based on well known devices and software. The authors experiments on LAN support for implementing a multimedia learning center, some particular problems and solution are take into account.

Some special services were tested in order to find some LAN limitations.

2. THE NETWORK STRUCTURE

The network structure is organized around a main backbone having a 10/100 Mb/s speed (see figure 1). The network element terminating the Customer Access Network (CAN) is the Edge Gateway (EGW); the network element connecting the Customer application to the access line is the Customer Gateway (CGW). To connect more networks this interconnection is accomplished by providing a LAN bridge for similar interconnection or a LAN gateway for dissimilar interconnection.

3. MULTIMEDIA ON NETWORK

A standard Intranet network has specialized servers doing different kind of access: web, ftp, mail, news, proxy.

Particularly studied applications are sound and video distribution using Intranet support: video/audio teleconferencing, video/audio broadcasting, video/audio supervising (figure 2).

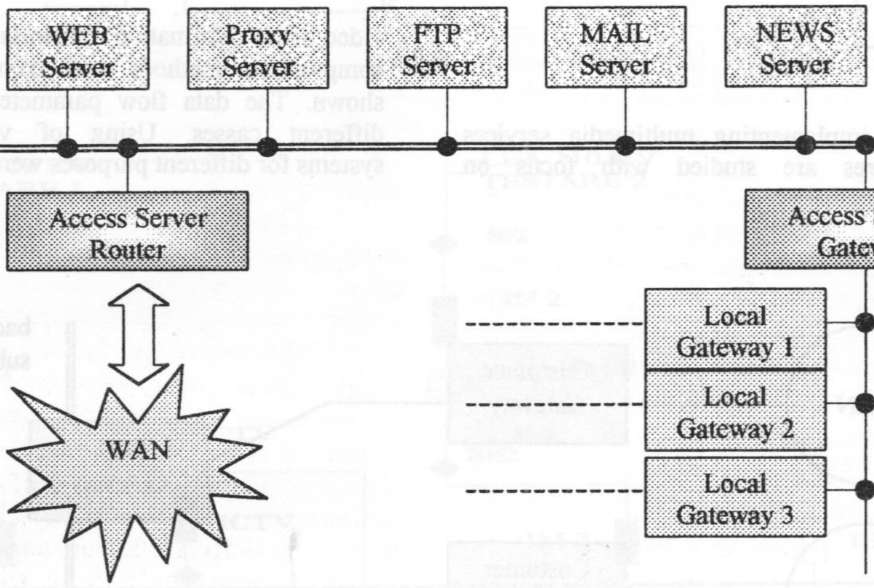

Figure 2. A Typical Intranet Network

3.1. Sound transmission

Concerning the sound transmission over the network a simply calculus show that for a limited band voice transmission, like phone vocal band, A PCM (pulse coded modulation) is used with 7 bits (in America and Japan) or 8 bits (in Europe) A/D samples conversion. Transmitting 8000 samples per second, a simply calculus gives a necessary data transmission rate of 56.000 bps, 64.000 respectively. The frequencies greater than 4 KHz frequencies are rejected.

For high fidelity sound (CD quality) we have to cover a frequency band of 22.050 Hz associated with 44.100 samples per second. Using a 16 bit conversion, we can have 65.536 amplitude levels (more than the human ear possibilities). Finally, there is necessary a band of 705.6 Kbps for mono sounds and 1,411 Mbps for stereo sounds.

As we can see, for high quality voice transmission over a LAN network without compression algorithm it is possible to transmit no more than 6 high fidelity voice channels simultaneously.

3.2. Video Transmission

For video transmission is necessary to send minimum 25 frames per second (to have continuity). Each frame usually has 640x480 (VGA), 800x600 (SVGA) or 1024x768 (XGA) pixels dimensions. For each pixels are used 8 bits for each color. So, we need (1024 x 768) pixels x 3 colors x 8bits = 472 Mbps binary speed.

Because the twisted pair network allow 10 Mbps, for transmitting video information it is necessary to make some compromises: reducing the number of colors (till 256 or 16 gray level or 256 color instead), reducing the number of pixels (the dimension of the image).

In order to increase the video delivery performance on the networks compression algorithms are used. Generally to coding methods are used: Entropy Encoding and Source Encoding. Entropy Encoding treats data bits without considering their particular signification. It has no loses and it is completely reversible. Source Encoding take into account the associated information for each bit or group of bits. Some information may be rejected with no important quality loses. The used encoding methods are: differential encoding, transformations (Fourier Transformation, Discrete Cosine Transformation) and vector quantization.

3.2.1. JPEG Standard

For static images (photos) JPEG standard is used. It supposes few steps: block preparation, discrete cosinusoidale transformer, quantization, differential quantization, length coding, output statistical coding. Here we do not discuss the algorithm. By this means we can obtain a 20:1 compression rate.

3.2.2. MPEG Standard

For digital movies some special standards are developed. One of them is MPEG-1 which can rich a bit rate of 1.2 Mbps heaving an acceptable resolution. It is meanly used for CD-ROM recording (I and video). The next step is MPEG-2 initialy developed for high quality video broadcasting. Now it includes some MPEG-3 unfinished standard futures concerning high-resolution video transmission. It needs 4 to 6 Mbps bits rate and is basicaly used for high distance video transmissions (TV broadcasting).

Compression rate is generally from 3 Mbps to 100 Mbps for HDTV, normally 3 to 4 Mbps.
In the same family we have MPEG-4 standard used for medium resolution video-conferencing at 10 frames per second with 64 kbps bandwidth.

So, a 10 Mbps network allow more than 100 simultaneous video/audio conferences if using the MPEG-4 standard.

Our user application consists in using video conferencing kit support like supervising system on the local network (figure 3). We try different video conference capture cards like BT848 from Brooktree and CL 5480 from Cirrus Logic. Commercial software was used like VDOPhone 3.0, Creative Video WEB Phone 3.0 , VocalTec Internet Phone 4.0.
The technical performances are quite similar in similar condition.

The aspects o which we must take care are:
-software drivers possibilities (for example, bt848 has no drivers for WIN NT)
-supported standards (MPEG-4 or compatible which need 64 kbps data flow) and protocols
-maximum number of simultaneous session, depending on the particular application
-other application running in the same time and which occupy parts of the traffic (audio high-fidelity broadcasting).

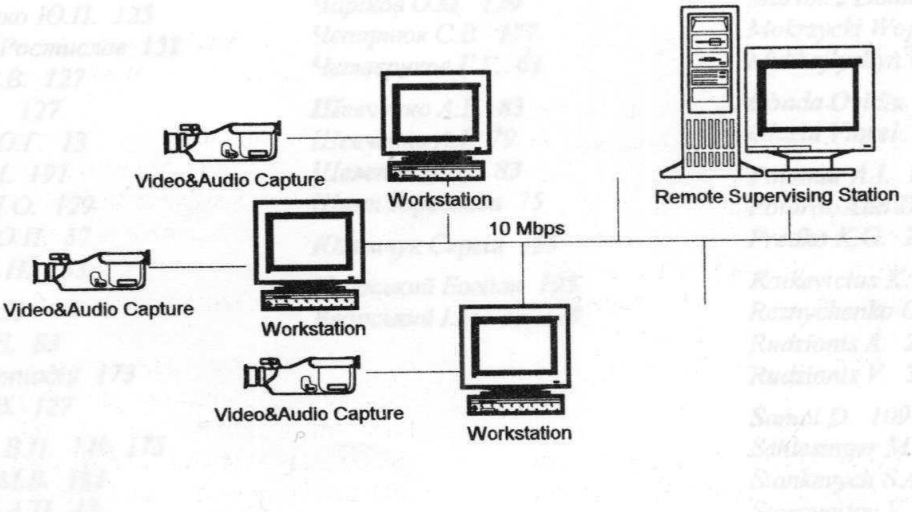

Figure 3. Video Supervising System on LAN

CONCLUSION

In order to have optimum results and avoid traffic congestion it is necessary to have in attention the network possibilities.

Depends on the particular application, some traffic calculus have to be made. As it was showen, for simultaneous teleconferencing or simultaneous video supervising a simply calculus (worst case) could confirm or not the local network state

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