A Universal Communication Server Family for Tactical Networks

1. The Philosophy

Right from the very beginning, it was intended to provide different users with an optimum solution which is modular and transparent and has an open system architecture. On the one hand, this server family should allow an economical solution, on the other hand, the interoperability requirements of different command and weapon control systems should also be taken into account. The PC technology offered the best prerequisites with respect to the basic components of the operating system, development tools, system services, etc. Only a communication core assembly which can be used universally and interoperably had to be created for the different technical subnetworks of the army.
The ATM communication server family now presents itself as a product conception. It consists mainly of COTS components which can be adapted to different platform requirements and degrees of ruggedization.

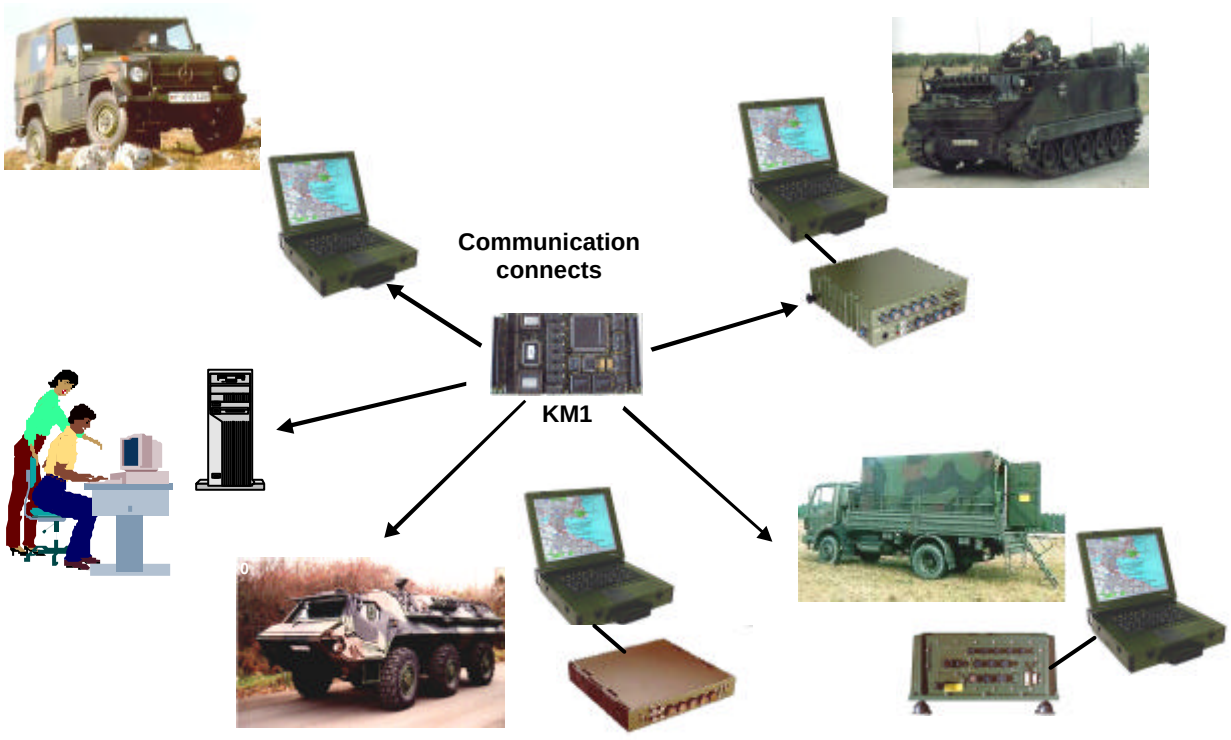

Fig. 1: Various Communication Options with the KM1 Communication Processor

2. System Architecture and Communication Software

The communication server is the link between the command and control systems, e.g., HEROS2/1 and GeFüSys, or the weapon system.
The hardware and software structure of the ATM communication server product family was strictly developed according to the system architecture defined in GeFüSys. This ensure the use in all command and control/weapon systems.

Operating System

The host processor of the communication server uses the operating system Windows NT as the most commonly used operating system for PC platforms with Intel processors. In addition to the user-friendly operator interface and a wide range of standard application software, the many system services and comfortable development tools, the permanent further developments as well as safety aspects by means of password protection and access rights are the main advantages.

Communication Software (Fig. 2)

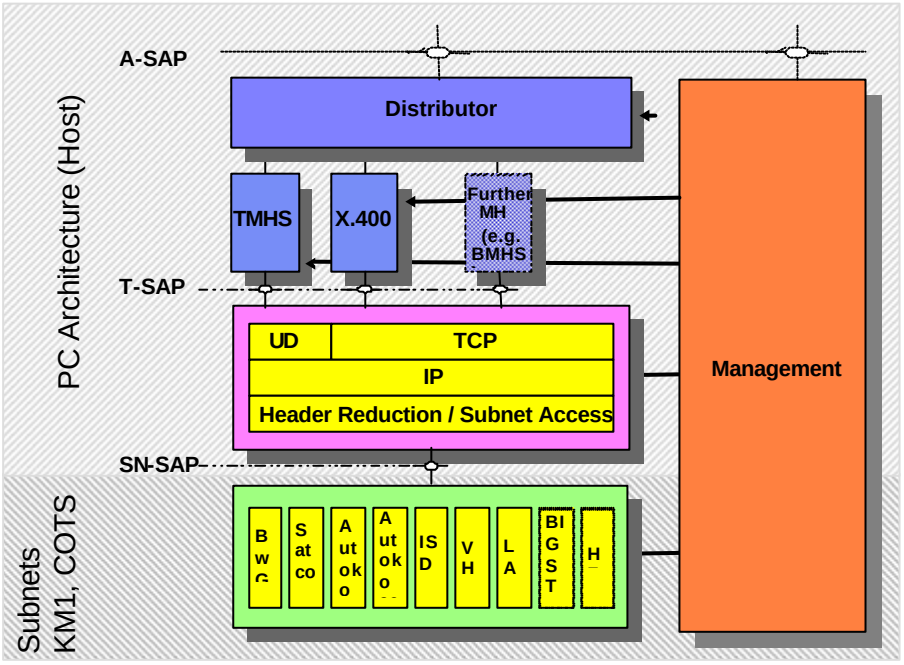

Fig. 2: Software Architecture of the Communication Server

According to the ISO layer model, the communication software is divided into three parts:

- Application-oriented layers 5 - 7, including distributor function via message handling systems such as, e.g., TMHS, X.400 and SMTP
- Transport and network layers (TCP/UDP) of layer 4 and IP as the network protocol of layer 3c
- Subnetworks according to layers 1 - 3b.

The interface standardization of the different layers supports the integration of different message handling systems as required either by tactical requirements of TMHS (Tactical Message Handling) for the radio subnetworks or X.400 and SMTP for public switched telephone networks. TMHS is a message handling system which is adapted to the reduced band widths of the radio networks and has been specially developed for this purpose.
While the application and transport oriented layers 3c - 7 run on the host, the protocol-specific parts, layers 1 - 3b, are implemented on the KM1/KMP communication processor (see Fig. 1 to Fig. 3).
The open software architecture allows, by means of the gateway function, the connection of already existing systems which have not been developed according to the GeFüSys standards.

Management Function

The communication server provides flexible and adaptable usage according to the specific topology of the user group. This makes possible the establishing of contact dynamically with a subscriber by means of various physical networks.
The management is divided into four functional blocks:

- Distributor management which controls the addressing of the subscribers via the different networks
- Management of message handling systems
- Management for the selection of the specific network, e.g., VHF, SatCom, etc.
- Management of physical subnetworks, e.g., transmission rate, call number, etc.

The management can be controlled by the user in tactical operations from the workstation.

KM1 Communication Processor

The KM1/KMP communication processor can be referred to as the core of the whole server product family. It was specially developed for handling military synchronous/asynchronous communication protocols. In addition to the applications for GeFüSys and HEROS 2/1, other army projects have been provided with the corresponding protocols. The communication processor has four different V.24/V.11 interfaces, two of which are data radio connections. Different radio circuits and several protocols can thereby operated in parallel.

The KM1 communication processor has been designed for integration in different Host environments.
The KM1 is available in different assembly forms. Fig. 3 shows the KM1 as plug-in module and as a PC card in PCMCIA format.

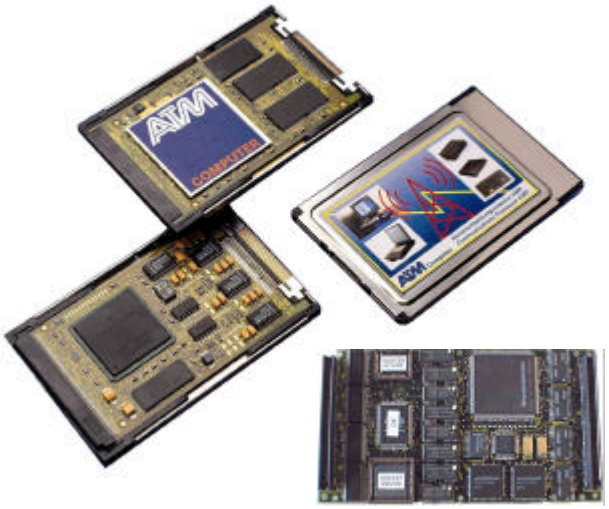

Fig. 3: KMP Processor Card

Subnetwork Connections

With the use of the KM1/KMP communication processor, ATM communication servers can be configured in a modular manner depending on the subnetwork connection required. The following subnetwork accesses are presently implemented:

- VHF data radio with HDLC for relatively low-interference networks and ECCM in environments with strong interference. The radio traffic can be handled alternatively via SEM 93 or SEM 80/90.
- Via the radio adapter FA16-K from ATM, data radio with SEM 80/90 is possible.
- The FA16-K can be integrated in practically every PC together with the KM1/KMP.

Fig. 4: FA16-K Module

- An integrated bridging function supports the so-called relay operation, i.e. a radio network subscriber which cannot be reached directly can be reached automatically via the integrated relay function of a subscriber that is positioned appropriately.
- HF data radio via HRM 7400 radio equipment with the MAHRS and HRS procedures.
- AUTOKO90, AUTOKO II and BwGN via Point-To-Point Protocol (PPP) and modem with V.25bis dial protocol.
- SATCOM connection for INMARSAT C.
- ISDN and Ethernet LAN by means of qualified standard components (COTS).
- Upgrading to BIGSTAF is possible at any time.

The communication protocols have been implemented in a real-time communications operating system. This ensures the effective handling of the parallel, time-critical protocols and, at the same time, optimum maintainability.
The flexibility and open architecture of the Communication Server supports the integration of all other possible networksystems, digital radios and protocols.

Integrated Communication Server

The open software architecture and the standardization of the software interfaces allow optimized design concepts. As shown in the COMMANDER example (Fig. 6), it is easily possible for the FüWES applications to connect the system software of the communication server with the application of a WES in a system. This means that only the physical subnetworks, e.g., KM1, are integrated in the weapon terminal or COMMANDER.

3. Application Examples of the Design Variants

Different systems were required for the development phase and the field test. The HEROS 2/1 and GeFüSys training systems have a PC tower solution with the corresponding subnetworks. MC2000KL units (Fig. 7) were integrated in cabins for command posts on batallion level applications where many subnet connections were needed.

For the FüWES applications, the COMMANDER with integrated or autonomous communication server was procured for the Wolf, M113 and TPz platforms (Fig. 6).

For the MIP program (Multilateral Interoperability Program), several type MCS2000KS units were procured for the development phase (Fig. 8).

Fig. 6: COMMANDER with integrated communication server

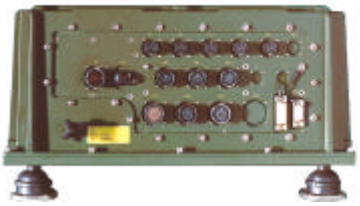

Fig. 7: Communication server MCS 2000 KL

Fig. 8: Communication server MCS 2000 KS

4. Adaptation to the Dynamics of the Hardware and Software Market.

The dynamics of the PC market require measures to keep abreast of the technological progress. The design structures of the different communication server allow the possibility of upgrading with respect to processor, memory and storage media. At the same time, the requirements with respect to long-term product maintenance and repair capability are met.
For the implementation on the LINUX operating system required for the so called pilot project 9.4.2 (KRK interoperability) for the Bundeswehr, only the porting of the communication software and partial adaptation is required. This does not affect the core elements of the communication server.

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