

# A Network is Only as Strong as its Nodes

## ATM Computer Systeme: Development Philosophy and Concept for Mobile Communications Systems.

Weapon and command systems are required to be highly mobile as well as to have high availability. The core (node) of data communications of the command and weapon systems is always a "communications center". Such a "communications center (KommServer)" which is also mobile is, on the one hand, subject to the special military requirements and the characteristics of the command or weapon system in which it is being used. On the other hand, when it is being considered over the life cycle of the systems, it is subject to the innovation of the software and hardware products.

When looking closer at these special requirements one determines that communications technology in the military environment is characterized by a multitude of:

- Standards, for example internet technology, etc.
- Communications media (wire, radio, satellite,...)
- Different communications protocols adapted to the media
- Different environmental requirements (ruggedization, installation specifications, etc.).

From all these, a functioning overall network is to be created.

Not only the technological variety but also the organizational separation of the responsibilities, just to mention the keyword "military services", resulted in isolated solutions which, although they satisfied local requirements, require additional adaptations among each other for global communications and interoperability.

The gateway functions are intended to solve the "language problem" of the different systems. In these gateways, not only the information transmission from one subnet to another is concerned but to a further degree also the solution of the global requirements of a global network described in the following:

- Network management
- Addressing in the complete network
- Special routing
- Redundancy mechanisms, also with inclusion of other subnetworks
- Special protocol characteristics and special information flow features (effectiveness, confirmations, acknowledgements, etc.)

The solution of these problems can be located only in uniform basis communications which, as far as the protocol characteristics are concerned, are based on "standards" which connect the different technologies via these standards. With such a concept, the overall system is opened for the use of standard services and utilities which are available on the market and can still meet the special feature requirements.

Such a global and ambitious approach conceptionally results in the software and hardware design principles for the communications systems which are listed further below:

- Modularity of the components (hardware and software)
- Transparency of the interfaces (hardware and software)
- Open system architecture on the basis of standards which are accepted in the market

When a communications system meets these requirements, solutions that are future-oriented and economical, but still demand-oriented for the individual command and weapon systems are possible and, in addition, the interoperability requirement of the control and weapon systems is met with this concept.

Last but not least such a concept also provides the possibility of opening up these military systems to innovative technologies (e.g., internet).

And now we come to the significance of the individual design principles:

- The modularity of the software and hardware components allows a flexible set-up of the communications systems and thus the adaptation of the hardware to predefined installation requirements and connection technologies. With respect to the software, this is the exchange of implemented properties and the supplementing with additional functionalities. This should generally not be a question of additional development effort, but actually only a question of configuration.
- The transparency in the interfaces, including internal interfaces, allows the adaptation of "exotic" protocols and software communications technologies. The software functionality must also be configurable to a wide degree which allows simply the adaptation of such exotics.
- The open system architecture on the basis of hardware and software standards which are accepted in the market allows adaptation in a simple manner to existing and also future communications media but also software functionalities, providing these comply with the standards. And this is, at least in the era of the internet, no longer a question, but a must.

On the software side, the military world already communicates to a high degree on the basis of the TCP/IP "standard". This means the military intranet and the global Internet are based on the same standards. It therefore suggests itself to integrate the military world with its special terminals and, to some extent, special protocol mechanisms and message procedures, into the standard world.

On the hardware side, the "standard" PC technology offers the best prerequisites with respect to the basic components of computer hardware, operating system, development tools,

system services, communications interface, etc. And therefore, it was and is mandatory to select the PC technology with respect to hardware and software as the basis for the communications computer systems, moreover as this technology offers itself also as link for the VME bus technology which was previously frequently but today less frequently used in the military environment.

This software concept and the software design principles mentioned are taken into account by ATM ComputerSysteme.

## **The Communications Center**

On the basis of these specifications, ATM ComputerSysteme has developed a "Communications Center" which is described in detail in the following. This "Communications Center", known under the name ATM KommServer with the Communications Modules KM1 / KMP, takes over the node function in the overall network of military communications.

The communications modules are available in various modular formats. They are made available as plug-in cards in the PCMCIA format or as plug-in modules on carrier cards in the ISA bus, but also in the VME bus and in ARINC formats and can thus be built into computer systems with the most different hardware and software bases.

Via the "communications center" the different tactical subnetworks can be served:

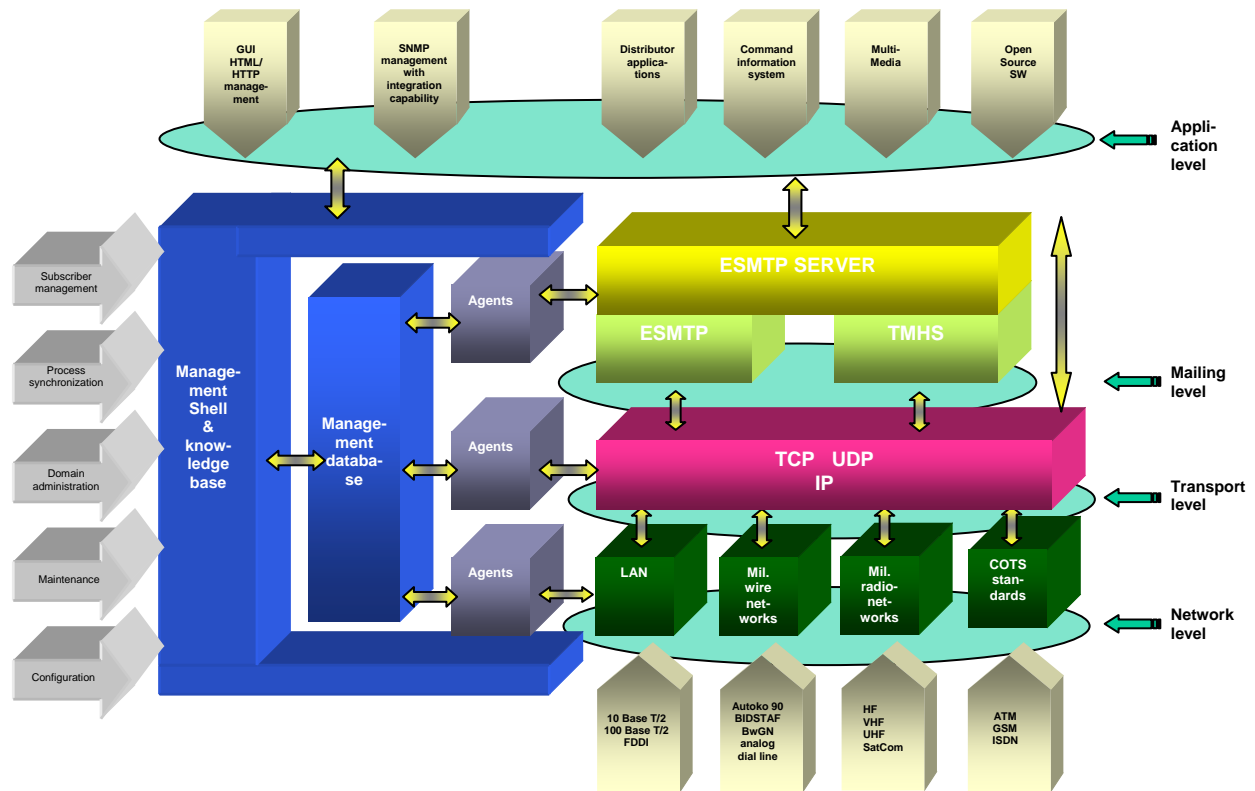
- VHF radio data transmission with the HDLC features for networks with relatively low interference and ECCM for environments with high interference conditions.
- HF radio data transmission with the MAHRS and HRS procedures
- Autoko II, Autoko 90 and BwGN
- SatCom

and through utilization of the corresponding commercially available COTS components, for example ISDN, GSM, etc., the civilian networks can also be served.

Today, the de facto standards for the transmission of messages are ESMTP and IP technology of which the worldwide internet is a practical example. It therefore suggests itself to integrate the military world with its special terminals and, to some extent, special protocol mechanisms and message procedures, into the standard world.

- The military networks (AUTOKO 90, BwGN, Funk and SATCOM) are adapted below the IP interface. Civilian networks, for example the internet, but also mobile radio, etc., are accessed via the TCP/IP or UDP-IP interface, i.e., a "data gateway" in the form of a "communications server" can be established any time which can serve both the military intranet and the civilian internet.
- Higher functions, for example mailing, can be easily implemented and made available.
- If the networks are built up with the communications modules (KM1/KMP) as nodes, the network management of these nodes can also be performed remotely, i.e. centrally and, if the SNMP interface and an MB are available outside the thus defined network, this "network extension" could also be performed remotely,
- Utilities which are supported by the standard interfaces can be easily adapted.

To what extent these concept and design principles, based on the example of the ATM communications modules, open up the world, is shown by the following software concept drawing describing our communications possibilities in the military environment.



The illustration shows the software architecture on the basis of the ATM communications modules KM1/KMP. Standardized interfaces, for example, LAN, ISDN, etc., can be integrated in parallel. Above the TCP/UDP layer, the structure is similar. Suitable military services, for example, various message handling systems (MHS) meet standards, ESMTMP for example, requiring coexistence in the manner of a global platform.

Due to the modular software structure, GOTS products (Governmental Off The Shelf), for example, TMHS (Tactical Message Handling System) can be used. Additionally, COTS products (Commercial Off The Shelf) with modern operating system services have grown into a variable and innovative system platform.

As an interface to higher applications such as standards browsers or command systems, the communications server makes available the standard ESMTMP interface. To meet globality requirements, all individual functions have management tangents which are provided by a central service to the user via a SNMP or HTML interface.

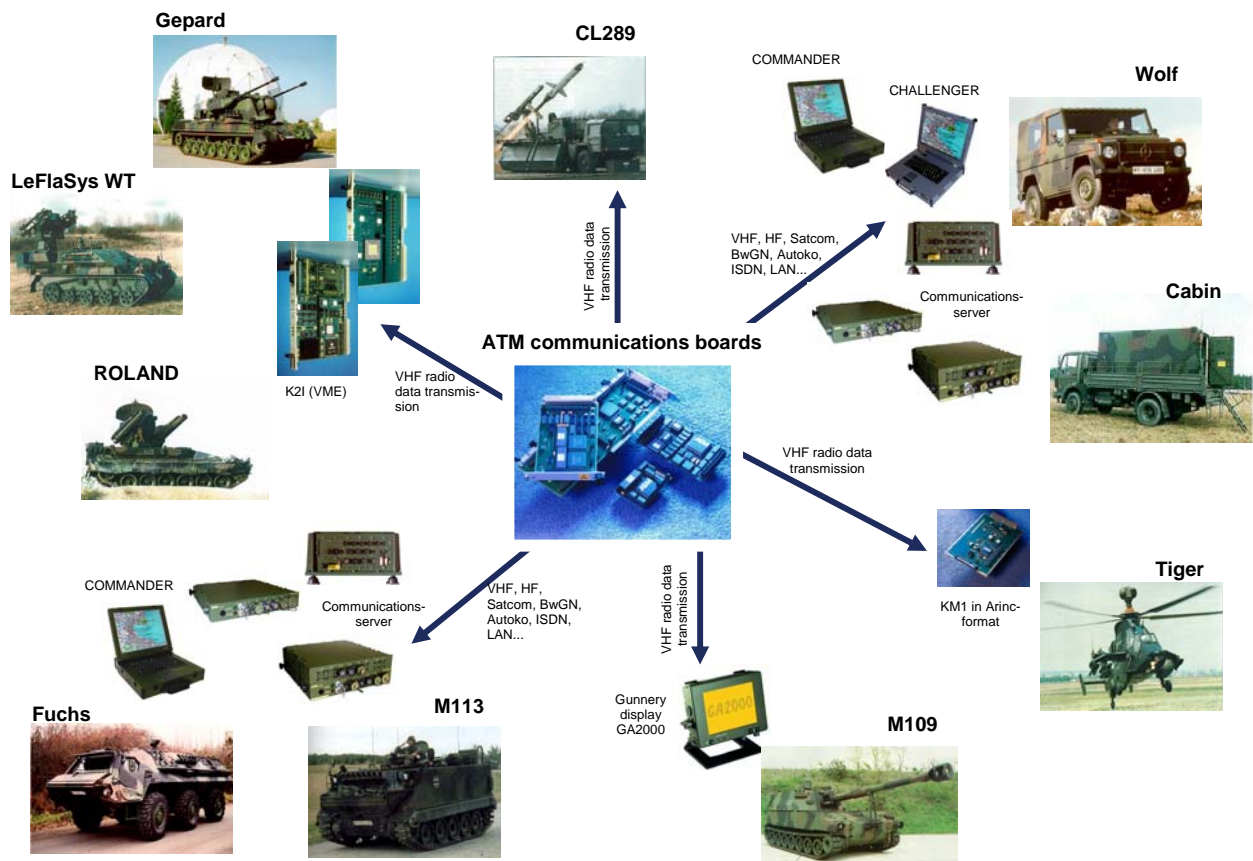
## The Computer Systems

Due to the multitude of project-specific requirements with respect to geometric dimensions, mechanical, thermal and electrical environment parameters as well as the resulting pricing, ATM has developed over the last years an equipment range which provides the buyer with the required flexibility for finding his special configuration.

These computer systems are characterized by:

- High modularity
- High mobility
- Resistance to strong vibrations (chain vehicles)
- Operation under high shock effects (howitzer)
- Temperature ranges in operation from approx.  $-35^{\circ}\text{C}$  up to approx.  $+60^{\circ}\text{C}$
- Special EMC measures
- Operation in unfiltered on-board power sources
- Safety from interception.

The following illustration provides an overview of already installed communications servers and communications media which are being used today in various systems of the Federal Armed Forces.





**ATM ComputerSysteme GmbH**

Max-Stromeyer-Straße 160

D-78467 **Konstanz**

Tel. +49.7531.808-45 71

Fax +49.7531.808-43 63

[www.atm-systeme.de](http://www.atm-systeme.de)