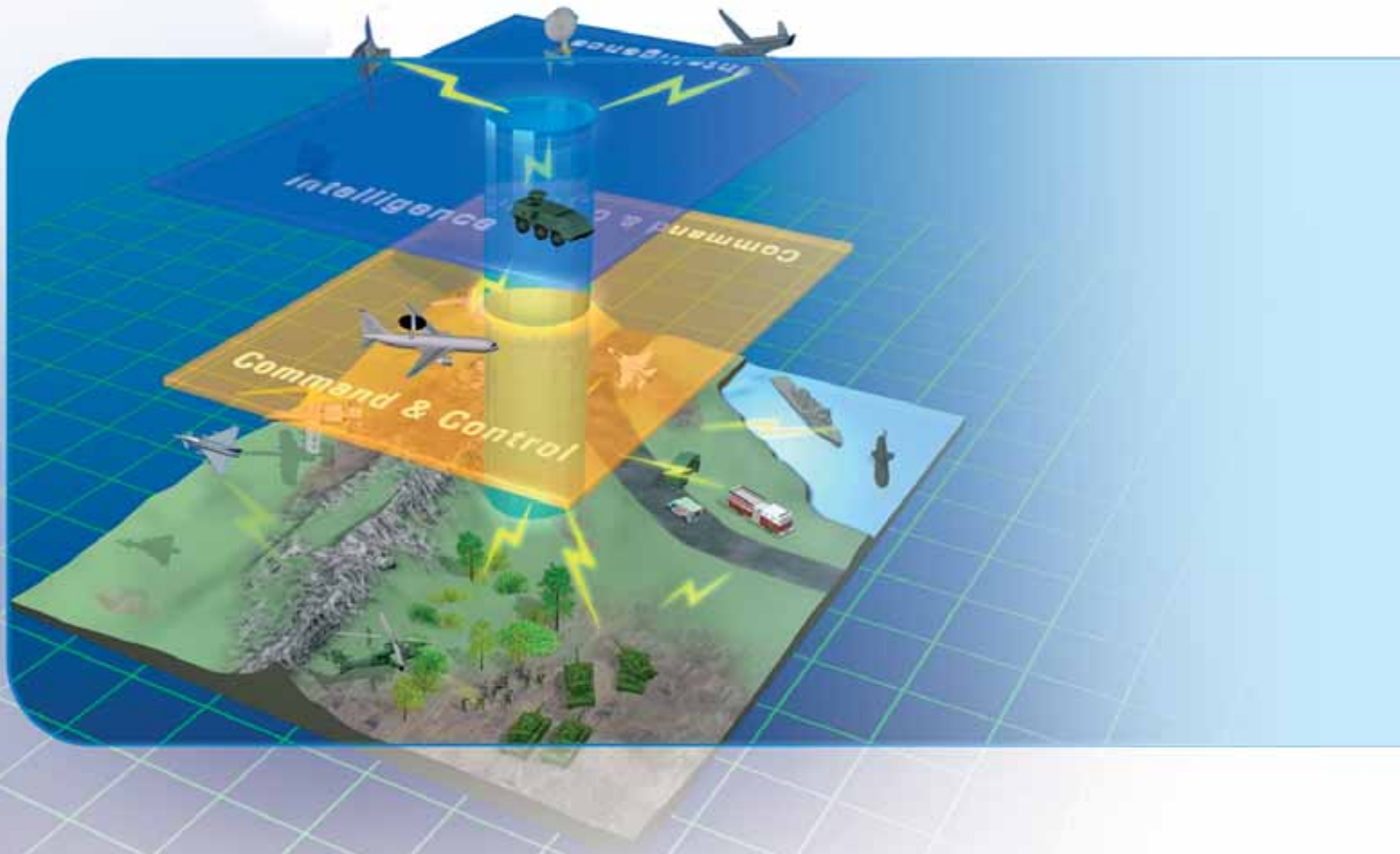


Your partner for modern and secure communications

Software defined radios as key elements in network centric warfare

ROHDE&SCHWARZ

Changes in mission concepts, the call for joint and combined operations plus the trend toward miniaturization and higher data rates are causing a paradigm shift in communications applications at the military and supranational level. The logical outcome is software defined radios (SDR). Unlike conventional radios, the basic functions and parameters of SDRs are no longer determined by hardware but by software.

The main focal point of today's concepts for military missions is network centric warfare (NCW). NCW is an effective military concept based on superiority in information when deploying forces. The idea is to provide required information in a suitable manner without delay wherever needed. This allows all command levels and parties involved (such as national forces, allies and partners) to have an up-to-date, harmonized situational awareness in near-realtime, enabling them to act in accordance with upper levels of command regardless of the distance between them.

The technical prerequisites are reliable means of communications that can be networked. But only SDR provides communications systems with the capability and versatility to implement network centric operations.

Modern communications

During the last decade, the expectations placed on modern communications networks have changed radically. Within recent memory, mobile phones and the Internet were reserved for a privileged few only. Today, following a brief phase of euphoria, both have become an integral part of everyday life. Being constantly available by phone or e-mail, being able to access information whenever and wherever required, and living in an increasingly networked world are now taken for granted.

Progress in computer and radio technology is making it possible for the first time to implement military concepts that are centered around this expansive networking of information. Synchronized action based on a common relevant operational picture is now also feasible with deployed forces. First, however, all defense forces must be networked by means of a robust and reliable system. In this context, the primary purpose of radiocommunications systems is to ensure comprehensive exchange of information with individual soldiers in the field and to be able to take action independently of hierarchical structures.

New military scenarios are creating new requirements

Mission scenarios have also drastically changed. In the past, military forces were primarily equipped and responsible for defending their own territory. Today, they perform a wide variety of new tasks, including providing humanitarian aid, establishing and enforcing peace in various corners of the earth and fighting terror on a global scale. However, few regions of the world offer a tight network of communications links like found in Central Europe. Military forces therefore need to be able to set up a powerful communications network in a short period of time using their own resources.

This communications network must ensure mobility, deployment and interoperability because of the size and physical characteristics of the operation area, the varying troop strength and organization, and the diverse ways of interacting. The requirements placed on communications links are also diverse and, in some cases, conflicting: Depending on the situation, large data volumes need to be exchanged, secure connections provided, large distances covered or the danger of enemy reconnaissance minimized. In addition, a communications system must be capable of ad hoc networking on the move.

Existing radio systems can meet these requirements only to a very limited extent. Different radio systems usually cannot communicate with each other or, if so, only by compromising on functionality (fixed-channel operation without encryption). Such systems have limited flexibility because of their largely hardware-oriented design.

Operational advantages due to new technologies

Software defined radios, on the other hand, do not face such limitations. Since analog radio signals can be converted into digital information, almost directly on the antenna, the functions can be configured in any manner needed. Only computing power, memory capacity and the characteristics of the hardware (antennas, amplifiers and A/D converters) restrict the technical capabilities.

SDRs open up a new world of possibilities. One of the most beneficial innovations allows the use of different waveforms on a single radio. By means of a simple rotary switch, the user can switch between waveforms (similar to speed dialing on a telephone), achieving interoperability with partners in urgent situations. The currently applicable parameter sets for waveforms, such as keys, fre-

quencies, etc, can be downloaded from an intranet or loaded via a fillgun. Since new software can be installed on the radios at any time, new waveforms can be easily added prior to and during a mission. SDRs provide significant operational advantages compared to present radios:

- Efficiency and protection of your own troops due to near-realtime update of the situation picture and transfer of operational orders and target data
- Interoperability by integrating weapon systems and divisional units (joint operations) and allies/partners (combined operations), which previously could not be integrated into the command structure for technical reasons
- Rapid deployability due to self-organizing network setup
- Flexibility and availability of the various means of communications to ensure smooth and secure command and control processes
- Increase in range due to flexible frequency utilization and relay function

International standardization

New technologies call for new standards. The Software Communications Architecture (SCA) has established itself as the standard for the next generation of SDRs. Being able to procure waveforms and radios from different manufacturers is one of the key advantages of SCA. This promotes cooperation throughout the industry and increases the reusability of equipment and software.

The main challenge faced by international forums is thus to standardize today's proprietary radio architectures.

Integrated logistics support (ILS)

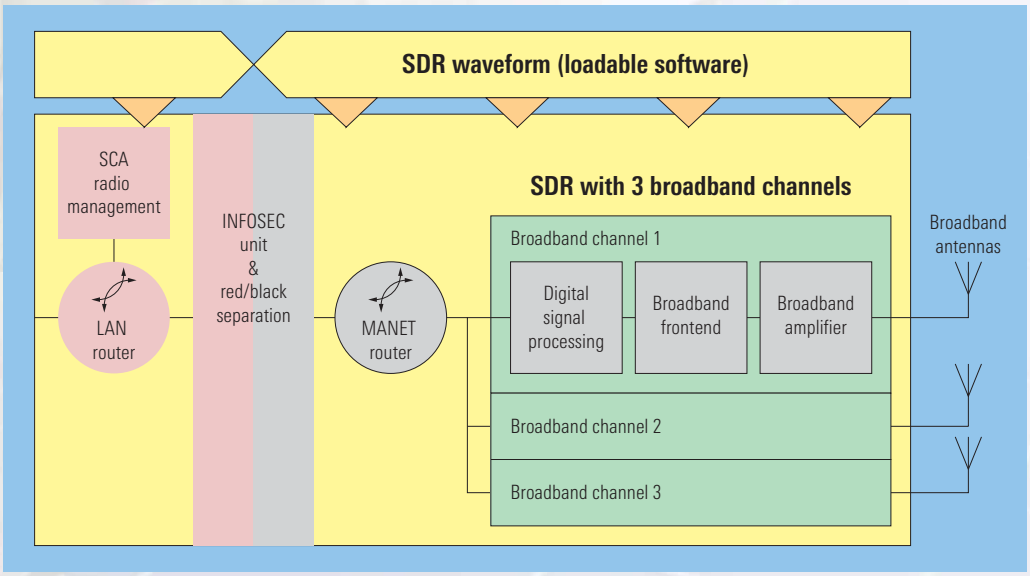
In addition, logistics costs can be cut by making intelligent use of modern ILS methods. Since hardware and functionality are largely separate in SDRs, different hardware can share a standardized user interface. Compared to previous radio generations, this drastically reduces spare parts procurement and provisioning as well as training and maintenance.

The medium-term trend is for software to be less platform-dependent. In addition to the above benefits, software porting costs will decrease. The systems are optimally designed to meet future requirements. Modularization enables today's architectures to adapt the product families to technology changes (technology insertion) at any time.

What the future holds

The currently available products and product families that are based on proprietary software architectures are key enablers for implementing network centric operations. One particularly important aspect here is military ad hoc networking in view of high data rates and long ranges.

In the last few years, Rohde & Schwarz has gained a wealth of expertise in modern radios, application portability and the increasing use of open standards. Future generations of radios will clearly benefit from this know-how. This is the only way to conquer the new challenges hand-in-hand with industry and defense.



Basic layout of a software defined radio (SDR)

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