SOLUTIONS BRIEF

Electronic Warfare Counterattacks In Half The Time

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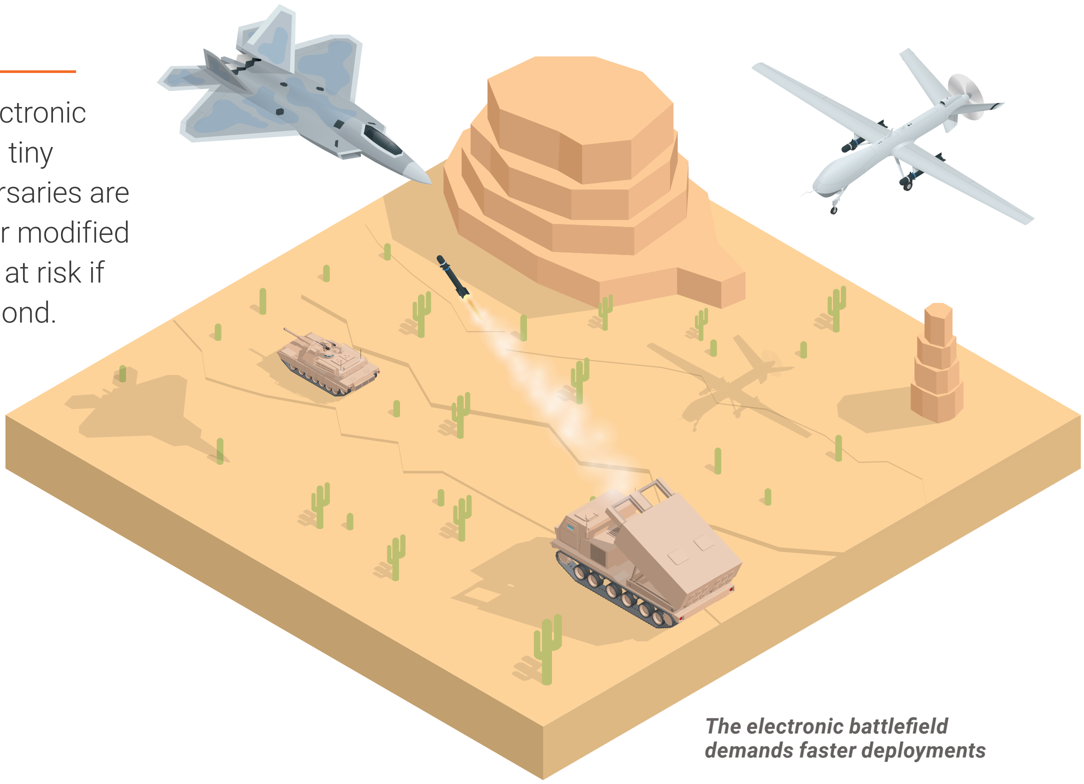
Electronic Warfare Counterattacks In Half The Time

Introduction

Invisible conflicts on the electronic battlefield are won or lost in tiny fractions of a second. Adversaries are continually deploying new or modified threats. Our warfighters are at risk if they're not equipped to respond.



The electronic battlefield demands faster deployments

The challenge is to accelerate deployment of advanced technologies that deliver a consistent advantage. While current development methodologies struggle with aggressive timeframes, there is an approach using modular software pre-integrated with leading-edge hardware platforms. This solution brief describes the concepts and implementation.

Faster Prototyping for New Concepts

Conflict on the electronic battlefield is continually evolving, with advanced technologies and new methods created to achieve advantage. As part of the effort, researchers develop innovative algorithms and techniques for manipulating and extracting information from RF waveforms, often in response to steps by our adversaries. The challenge is to quickly evaluate research for practical value and develop the most promising approaches for deployed systems.

Creating the hardware and software systems for this prototyping has traditionally been a lengthy, labor-intensive process, moving thru long cycles of design, configuration creation, coding, testing, adjustments, and more testing. Finally, after a realistic prototype system is built, meaningful performance data for a new research concept is captured.

Fortunately, there is now an approach, based on planned code re-use, that compresses and simplifies the prototyping cycle using deployable hardware platforms. This approach gives insight into what is possible during real-world execution and results in systems poised for the next stage of development.

An Integrated, Modular Approach

Abaco Systems, a global leader in aero/defense embedded computing, has partnered with AMERGINT Technologies to combine AMERGINT's SOFTLINK™ libraries and development tools with Abaco's powerful lineup of hardware platforms. SOFTLINK uses modular software devices, termed SwDs (pronounced 'Swedes'); these are linked into processing chains to build customized, optimized applications.

There are currently over 1,000 SwDs available from AMERGINT. They are small, each one focused on performing a single function, making them highly reusable. Designers select the set of SwDs needed to implement their application. Then, using the SOFTLINK architecture, they are connected with standard data interfaces to form an application-specific processing chain. Together, they define the sequence of processing from a signal/data input to an output.

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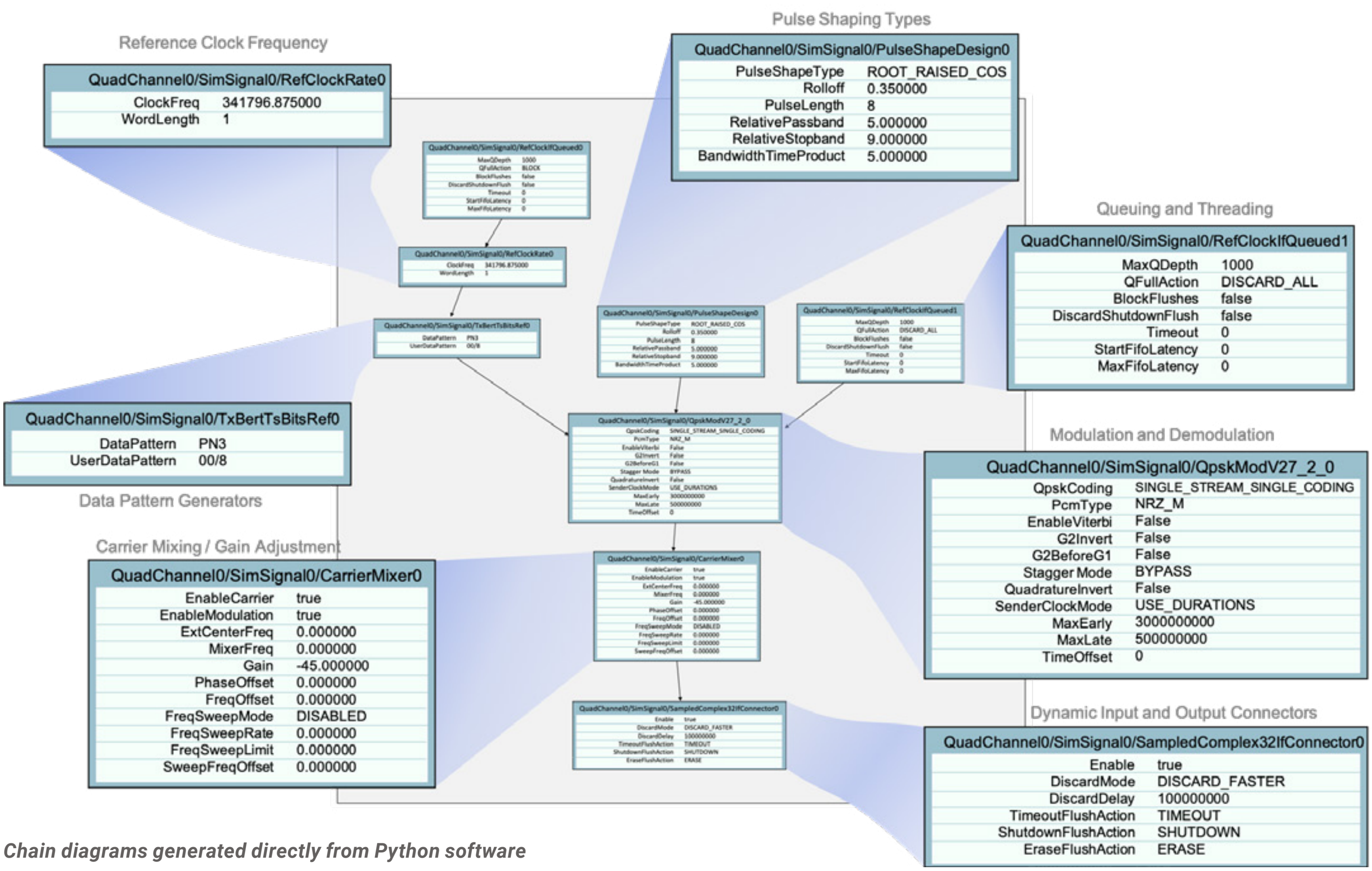

Chain diagrams generated directly from Python software

LEGO® provides a simple analogy. Just as a child can build nearly any airplane, racecar, or spaceship out of a tub of modular bricks, developers can build prototype software for radars, EO/IR imaging, and EW systems, starting with the libraries of existing modules and then adding customized SwDs.

Many SwDs are optimized for RF communications and other real-time processing operations. There are also a large number of 'utility SwDs' for functions such as interface conversion and controls for data queues, threading, and switching. Network and file I/O are other examples of areas supported by a broad selection of SwDs.

Using these off-the-shelf software modules, a functioning embedded application prototype can be constructed in a matter of days. Then, additional features are typically added using customized SwDs; AMERGINT has developed roughly 250 customer-specific modules in support of successful, real-world solutions. The native environment for SOFTLINK is Linux® on an Intel® processor, with code cross-compiled to execute on a range of target embedded processors.

During application development, processing chains are implemented using the Python software language to select SwDs, place them in a functional order, and define the interfaces between them. Python also serves to document the application in diagrams, with data flows, configuration parameters, and default values. These chain diagrams of connected SwDs are automatically generated and, after any modification, regenerated at run time. Easily viewed in the development environment's UI, the diagrams are a straightforward way for all team members to have a consistent, up to date view of an application's development status.

The SOFTLINK architecture is designed to handle multiple data streams, which are often combined, split, switched, and routed to execute application functions. An impressive example is the application handling communications for the International Space Station. This SOFTLINK implementation has more than 1200 SwDs, managing nearly 50 unique data streams, all in real time, and at an aggregate continuous data rate of over 450 Mbps.

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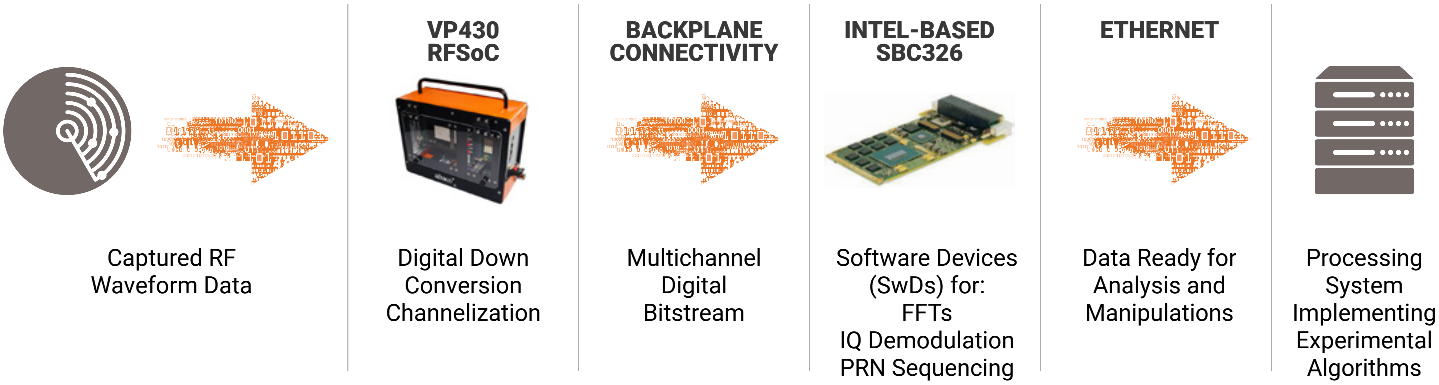
Rapid Prototyping Data Flow



An Abaco-AMERGINT Rapid Prototyping Configuration

The Abaco-AMERGINT partnership is focused on delivering an integrated hardware/software combination specifically for embedded defense prototyping. Using proven Abaco hardware modules and AMERGINT SwDs for signal processing allows development teams to rapidly implement and evaluate new algorithms from research labs.

The first step is moving captured RF waveforms into a VP430 RFSoC Platform (see sidebar) for digital down conversion and channelization. The flexibility of the VP430 allows straightforward optimization for the waveform and specific application.

The digitized bitstream leaving the VP430 is transferred via a wide bandwidth backplane connection to an Intel-based SBC where pre-configured AMERGINT SwDs implement the necessary signal processing steps, such as FFTs, IQ demodulation, and PRN sequencing. The output from the SBC is a data stream ready for analysis and application-specific manipulation.

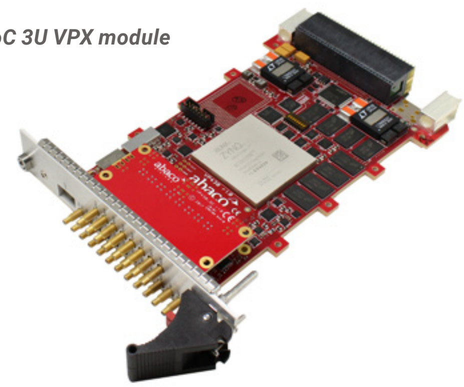
This data stream moves via an Ethernet connection to a server system where experimental algorithms can be implemented, modified, and tried again until a desired result is achieved.

Prototyping with this approach saves valuable time, as well as reducing cost and program risk. With large sections of the signal processing chain managed by proven hardware and SwDs, developers can focus on new, application-unique functions. Then, when an application is ready to move forward, the same Abaco hardware can be used for deployment, with identical characteristics for sample data rate, ENOB, signal fidelity, etc.

Seeing is Believing

Engage with the Abaco-AMERGINT team to see a demonstration of this system and learn how it was created. Then discuss with us how we can help accelerate prototyping for your next generation embedded applications.

The VP430 RFSoC 3U VPX module



VP430 RFSoC Platform

The VP430 is a 3U VPX RF processing system featuring the transformational Xilinx® ZU27DR RF system-on-chip technology (RFSoC). It is one of the densest analog FPGA DSP boards available, packing multiple processing units and ADC/DAC capability into a single 3U VPX slot.

Designed for advanced EW applications, the VP430 is a major step forward in performance and density.

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