



DataSoft Corporation

Product R&D and Engineering Design Services

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Capabilities in
Embedded & Communications Systems
Design, Development, Integration & Test

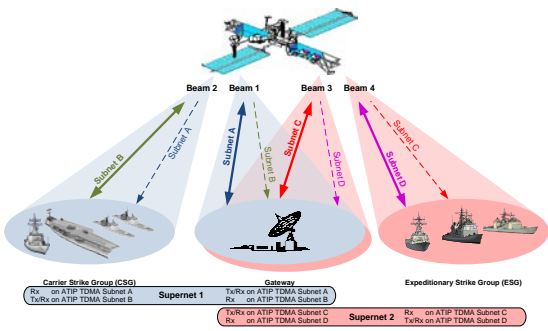
DataSoft designs & manufactures products and custom solutions for command, control, computer & communications systems.

- Domains: Defense, Industrial, Public Safety
- Focus: SBIRs, Govt. RFPs, Industry Projects/Products
- Strengths: Embedded software, modeling & simulation, automation
- Customers: US Army; SPAWAR, USMC; Comtech, Thales, General Dynamics, Intel, Trimble, Lockheed Martin
- Partners: Samsung, Motorola, Select Engineering, NXP
- Small business; based in Tempe AZ since 1995. Secret-level FCL, PCL

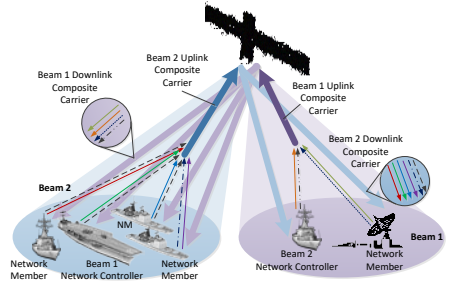
Relevant Projects



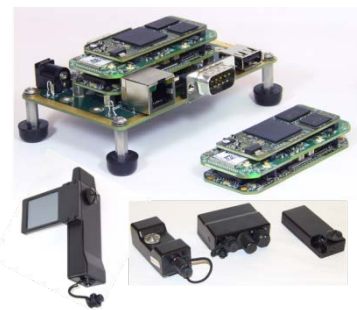
ATIP/ATIP-AC



T-SCAN Phase I



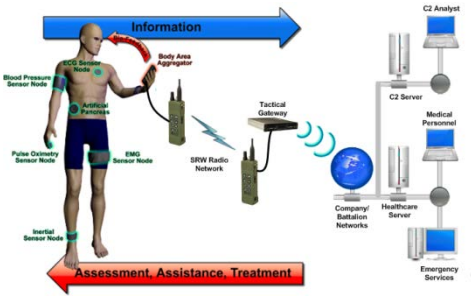
IoT Modules & Software



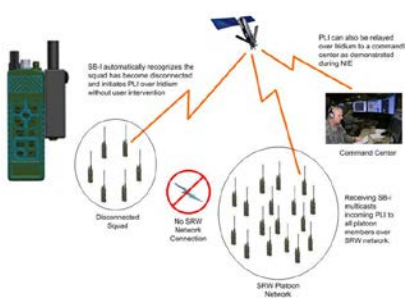
Wearable Sensors for force protection



Body Area Networks



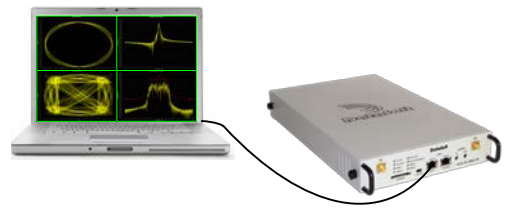
Iridium add-on for Rifleman Radios



Tactical Network Monitoring Apps



SDR Development & Test Platform w/Probe tool



Differentiators



- **Performance**: Customers include Trimble, General Dynamics, Comtech, Lockheed Martin, Thales, Intel, US DoD
- **Intellectual Property**: SDRs, IoT module, IP-networking software libraries, low-power RF. All available for re-use
- **R&D and Proposal capability**: 14 Phase II SBIRs; teammate to GD, Lockheed, Comtech on winning proposals
- **Rapid prototyping** capability in RF and mechanical systems – quick turnaround, flexible, agile, nimble
- **Exporter** of radio products and software to France, UK, Poland, Brazil, and India
- **Security** expertise: CSfC solution (under NSA evaluation) for Secret & below wireless communications.
- **Process**: CMMI Level 3 equivalent process-based development.

Relevant SBIRs



Topic	SBIR Title & Product/Technology	Status
N173-143	Transponded Satellite Communications Ad-hoc Networking (T-SCAN)	In Phase I
A16-070	The Internet of Things for Body Area Networks – intra-soldier network, aggregator app to integrate sensors with Nett Warrior.	In Phase II
A12-047	Resources Management in Peer-to-Peer MANET Communications Environments: 3-protocol software stack for network monitoring	Army Phase II
N111-085	Real-Time RF Channel Impairment Emulator	Phase I complete
N102-187	Spectrum Fragmentation of Networking Waveforms with Distributed Network Control	Phase I complete
AF103-085	Agile Space Radio (ASR)	AF Phase I complete
	SideBridge-Iridium for 154/A– radio accessory to provide Iridium capability, common radio MIB, UTR-related ODIN messages	Army Phase II on-going
A10-014	Spoofing Network Architectures in Response to Hostile Reconnaissance – Honeypot based network intrusion detection	Phase II complete
N093-219	Network Operations (NetOps) Data Optimization Engine	Phase I
N093-227	Automated Analysis and Verification of Application Program Interfaces (APIs)	Phase I, II, II.5 complete
A09-060	Virtual RF Environment	Army Phase II Complete
A08-108	Software Defined Radio Tool Suite – Software to port and debug waveforms into SDRs	Navy Phase II Complete
A08-225	WNW Enhancement	Phase I
N08-091	Middleware Specification for Low-Power Distributed Processing Devices	Navy Phase I complete
N08-087	Next-Generation Mobile Software Defined Radio – Thunder SDR for WF development & testing	Phase II Complete
N08-224	Universal Radio Frequency (RF) Communications Transceiver	Phase II Complete
AF071-072	End-to-End Performance Management for RF Networks	AF Phase I & Phase II
	Secure Wireless Access Points for Tactical Radios (117G) – Provide secure WiFi & Bluetooth to EUD	USMC Phase II complete
	Android Apps for the Rifleman Radio & SRW – Network status monitoring app	Navy Phase II & II.5
AF06-317	Automated Analysis of Datalink Transmissions (AADT)	Phase II Complete
AF05-312	Joint Tactical Radio System (JTRS) Wideband Network Waveform (WNW) Host Simulator (WHS)	Phase II Complete

Engineering Expertise



System Engineering:

- System requirements and design: CONOPS, ICD, SRS, SSDD, SDD, HDD, schematics
- Standards-compliant hardware and software design
- OPNET based network modeling & simulation

RF Design:

- Custom RF Design, PCB, Digital Design, Mechanical, Rapid Prototyping
- System-on-Module for IoT devices; WiFi and Bluetooth (Classic & BLE) accessories for tactical radios
- Software Defined Radio Development HW (30 MHz – 4 GHz)

Waveform Porting/Analysis:

- Waveform development environment: GPP, FPGA, DSP
- Drivers, BSP, waveform loading tools
- SCA-Compliance and metrics analysis tools

System Integration & Test:

- ATE design, environmental test, test fixtures
- Software and hardware in-the-loop validation with network test beds
- Realistic tactical MANET scenarios simulation-driven test: weather, mobility, traffic, and terrain

Digital and Analog Design:

- FPGA/CPLD hardware design and VHDL development
- PCB Design, Simulation, Layout, and Fabrication Services
- Mixed-signal devices: ADC/DAC, Direct Digital Synthesis (DDS) and IF signal processing
- Modem building blocks (modulation, FEC, DSP, algorithms)

Application Software:

- IPv4/IPv6 networking; Layer-2 bridging, routing; QoS, Bandwidth mgt; traffic prioritization; congestion avoidance; MANET management software
- C, C++, Java, GUI, Netbeans, Eclipse, GWT, Linux, Android, JSON, REST, C#
- Network Modeling & Simulation using OPNET
- Software Probe Tools, API Verification, Nimbus SDK

Real-Time Embedded Software:

- BSP, Boot Loaders, File Systems; Kernel development, Device Drivers
- Peripherals: UART, WiFi, BT, USB; ARM, DSP, Vybrid, microprocessors
- SCA-Compliant software (GPP, DSP, FPGA): radio devices, radio services, RF control, power management
- Communication Software: Radio services, radio devices; RF control, power management; Cryptographic application software; OE embedded software

Sensors & IoT Technologies

Components for IoT devices

- Compact dual-core Vybrid SOM for flexible processing and network connectivity
- Miniature form factor with stacking connectors
- Carrier boards with Bluetooth, Wi-Fi, GPS, LAN, USB, display interfaces for M2M and IoT applications
- Complete Board Support Package software (Yocto Project-based) for SOM on each carrier board
- Bridging and routing software for wireless IP-based communications to smartphone
- Interfaces: Ethernet, USB, Serial (UART, SPI, I2C), Audio, LCD, User-defined



SideBridge SOM



Stackable carrier boards

Example Applications



IoT development kit

SideBridge-RAP for PRC-117G



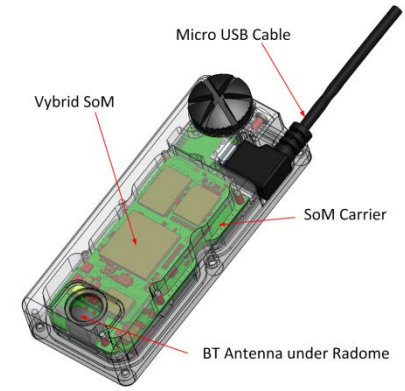
- Detachable Radio Access Point (RAP) module with Bluetooth and WiFi to create WLAN for PRC-117G radios
- Dual encrypted channels to meet CSfC requirements
- Ability to connect 5 users to the radio simultaneously
- Switch to turn off RF for radio silence mode.
- Zeroize button to clear keys
- USB port to connect EUD via cable
- Meets most of NSA's CSfC WLAN Component List & Campus WLAN Capability Package requirements
- Lab and Field tested at TRL 7



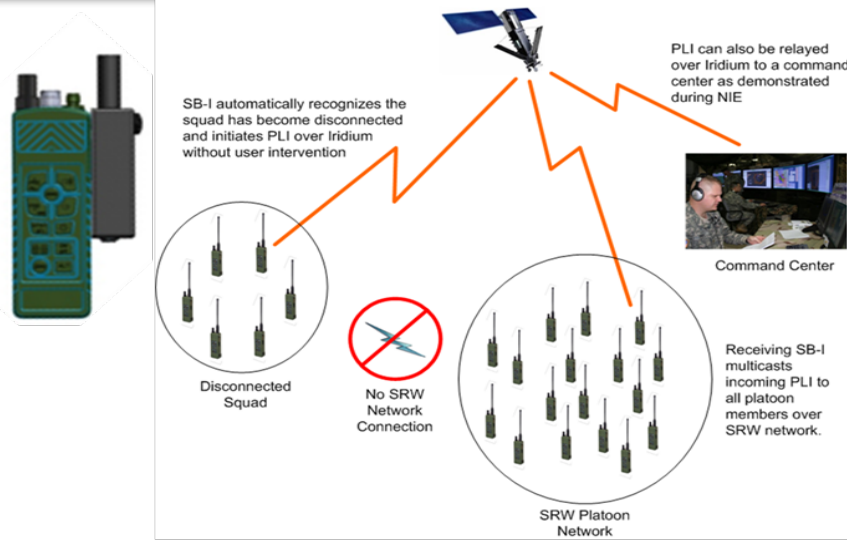
SideBridge Modules for tactical radios

	SideBridge (v1)	SideBridge (v2)	SideBridge (v2)	SideBridge LCD	SideLink	SideMate	SideBridge RAP	SideBridge Iridium
								
Radio model	AN/PRC-154/A	PRC-154(A)	PRC-152(A)	PRC-154(A)	MBITR2	MBITR2 w/SIAM	AN/PRC-117G	AN/PRC-154/A
Radio brand	Rifleman Radio	Rifleman Radio	Falcon III	Rifleman Radio			Falcon III	Rifleman Radio
Radio manufacturer	GD / Thales	GD / Thales	Harris	GD / Thales	Thales	Thales	Harris	GD/Thales
SideBridge platform	OMAP	Vybrid	Vybrid	Vybrid	OMAP	OMAP	Vybrid	Vybrid
Bluetooth	Yes	Yes	Yes	Yes	Yes	No	Yes	No
WiFi capable	Yes	Yes	Yes	Yes	Yes	No	Yes	No
GPS	No	No	No	No	Yes	No	No	Yes
External USB	No	Yes	Yes	Yes	Yes	Yes (x2)	Yes	Yes
External Serial	No	No	No	No	No	No	No	No
External Power	No	No	No	No	No	Yes	Yes	No
CSfC Encryption	No	No	No	No	No	No	Yes	No
Other		MMP in development	Uses Adapter Plate		Wide/Narrow Band I/O	MBITR2/SIAM I/O		Connect serial devices
Status	End-of-Life	Available	Available	Available	Available	Available	Available	Available

- All modules have CPU and memory to host applications
- Bluetooth and WiFi can be turned off
- All modules run Linux OS
- Options include WiFi, Bluetooth, GPS
- Can meet CSfC Components List requirements – WLAN Access System, IPsec VPN Gateway, Traffic Filtering Firewall



SideBridge-Iridium for Rifleman Radios



Purpose:

To transfer Position Location Information (PLI) data reliably to upper echelons under all conditions. Maintains Blue Force Tracking (BFT) capability as it is critical in helping to build Situational Awareness (SA) and mitigate friendly fire casualties. Also supports UTR.

Approach:

Our SideBridge-Iridium module allows SRW networks to stay “PLI connected” with Iridium constellation reconnecting one or more nodes that become SRW disconnected. Operates in fully dismantled mode as device operates off Rifleman radio power and data. The VMF filter on the Iridium connection is being opened to also support ODIN message transfers to support Unit Task Reorganization (UTR) between platoons. The Common Radio MIB capability is being added to monitor and control the SideBridge-Iridium runtime configuration.

Technology Development Milestones

Milestone	TRL	Risk	Measure of Success	TRL Date
SBIR Phase II hardware and software design and development	6	Low	10 SideBridge-Iridium modules delivered	Jan '17
SBIR Phase II – Integration with Rifleman radios. Functional testing in lab and field environment.	7	Low	Successfully tested with platoon sized network during AEWE 2018.	Apr '18
Post SBIR Phase II – Operational testing as part of AEWE, TECD, or NIE event.	8	Low	Successfully integrated with dismantled troops and upper echelons	May '18
Phase III - Technology insertion into program of record with transition partners	8/9	Med	SideBridge-Iridium module added to contract vehicle	Jul '18

Product or Result:

The SideBridge-Iridium module attaches to the Rifleman Radio and Nett Warrior EUD and automatically sends Position Location Information (PLI) over the Iridium network when the radio(s) is out of network, is out of power, or has failed.

Payoff:

BFT is maintained despite the terrestrial radio range limitations and radio power/PLI failure thereby improving soldier safety and operational effectiveness in a very economical manner.

Transition Partners/Phase III Opportunities:

- Army PEO C3T – Accessory contract for Rifleman Radio
- Thales Defense and Security – Resell partner
- Harris Corporation - Resell partner, adapt to other radios
- Accepted into AEWE 2018 under Expeditionary Tactical Network

SideBridge-Sensor Module



- The SideBridge-Sensor (SB-S) provides unattended communication capability for sensors via WiFi & Iridium.
- Using worldwide Iridium satellite coverage, the SB-S module provides an intelligent, reliable method for transporting sensor data anywhere in the world.
- Sensor data can be unicast or multi-cast (to 5 receivers)
- Built-in SideBridge-SoM provides a Linux environment to host apps and for remote management
- Interfaces include USB and Ethernet
- Unattended operation -- rechargeable battery operates for >24 hours with transmissions every 30 seconds.
- Compatible with both legacy Iridium and NEXT

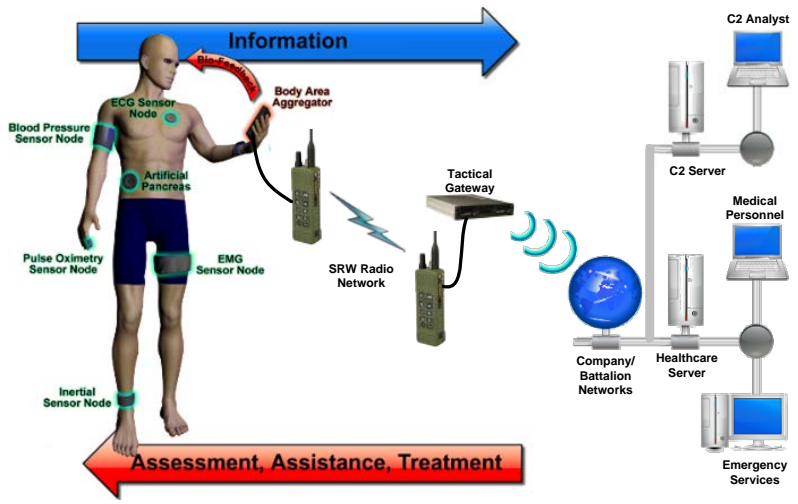


Body Area Network for DoD



Technology

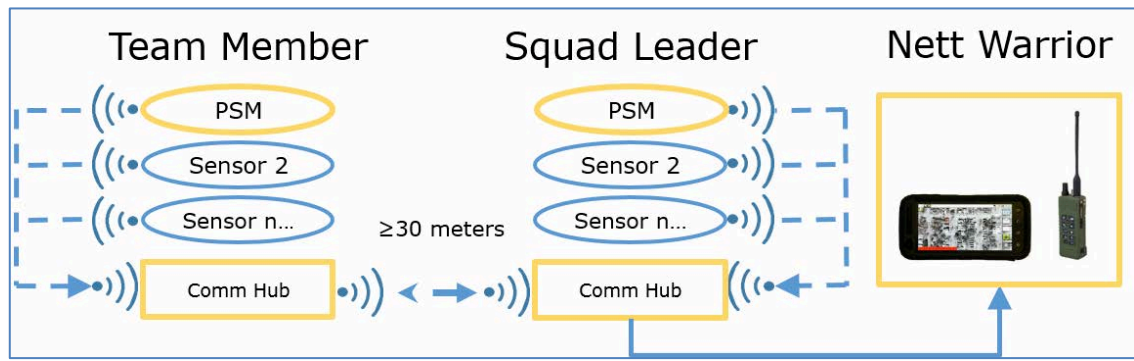
- Personal BAN – WiFi/BT/UWB/Mesh
- Gather/fuse sensor data
- Use WAN between comm hubs
 - Scalable & Disruption tolerant
 - Low bandwidth links
 - Flow control
 - FIPS 140-2 compliant
- Open architecture
- Standards-based



Use Cases

- Logistics
- Equipment monitoring
- Casualty detection
- Situation Awareness
- Soldier Performance
- Physiological Status

Army Squad/Team Use Case



Active Sensor for Public Safety



AID sensor panel
With Bluetooth
transmitter



Piercing incident in front
or back sensor panel
from bullet, knife,
shrapnel, etc.
automatically generates
emergency signals



Man-down and GPS
location sent to all officer
radios and dispatch



Automated SMS
message sent to
recipients with officer
information, injury
zone and GPS location



MONTGOMERY COUNTY SHERIFF'S OFFICE (VA)



"If we're not talking officer safety and sending our men and women safely
home to their families then we're not having a conversation I want to have"

Sheriff C. H. "Hank" Partin

AID AUTOMATIC INJURY DETECTION

1ST LAW ENFORCEMENT AGENCY TO DEPLOY **AID** FOR BOTH
LAW ENFORCEMENT AND CORRECTION OFFICERS

DataSoft

- Automatic Injury Detection (AID) detects a piercing event and automatically sends an alert
- Adapts communication requirement to sensor/IoT: Bluetooth Low Energy module; VHF transmitter; Android App; Radio network connectivity

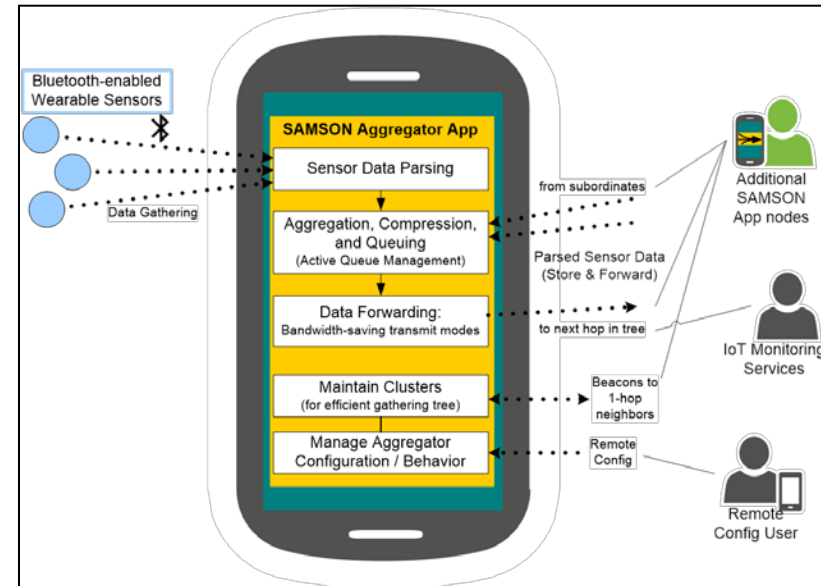
Sensor Integration Projects



Soil Moisture IoT sensors integrated with weather



Baby
detection &
alert sensor



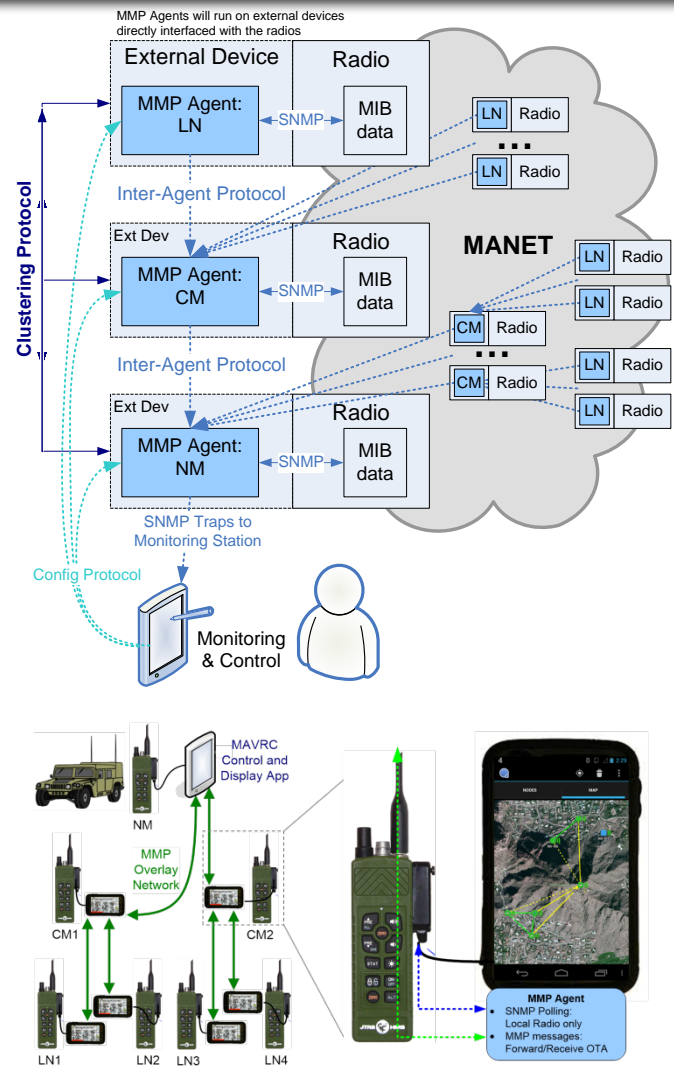
SAMSON solution for Body Area
Network sensor data collection and
fusion

Command, Control & Communications Systems

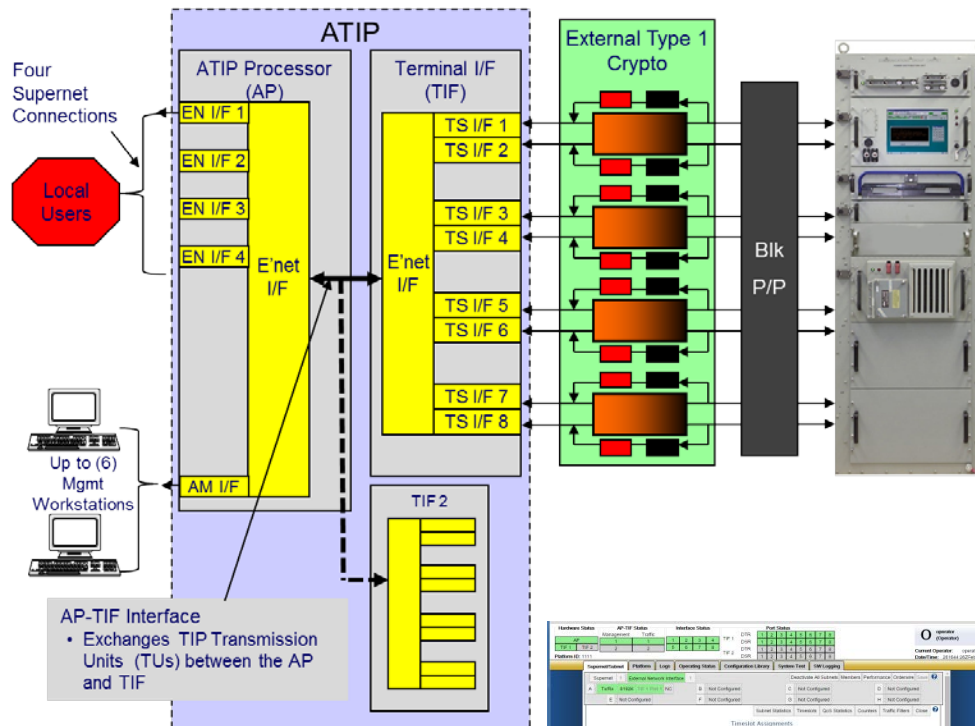
MANET Monitoring Protocol (MMP)



SBIR Phase II A12-047	Resources Management in Peer-to-Peer Mobile Ad Hoc Network Communications Environments
Goals	<ul style="list-style-type: none"> • Efficient use of wireless medium; enable better scalability in MANETs • Disruption-tolerance: don't assume network is low-delay or high-reliability • Adapt dynamically to current local network conditions
Methods	<ul style="list-style-type: none"> • Software Agents: a decentralized approach that distributes tasks and intelligence across the entire network • Clustering: a self-forming and self-healing overlay network of MMP agents that facilitates efficient network-wide broadcast/gathering functions • Adaptive Forwarding: a store-and-forward mechanism combined with QoS-like throttling of monitoring traffic
3 Protocols	<ul style="list-style-type: none"> • Clustering Protocol: forms the overlay network of agents in any IP-based network, e.g., SRW, WNW • Inter-Agent Protocol: Disruption tolerant forward of network mgt data • Configuration Protocol: Allow network manager to control agents, could be replaced by OTAM
So What?	<ul style="list-style-type: none"> • Complements OTAM, which is slated to be the "killer app" for SDRs • Can run inside radio, or, on dongles • Can be in-band, or, use WiFi or Bluetooth too • Applications not limited to network management. • Other network functions can also be more efficient. • Saving bandwidth translates directly into saving power.



ATIP supports Navy NMT

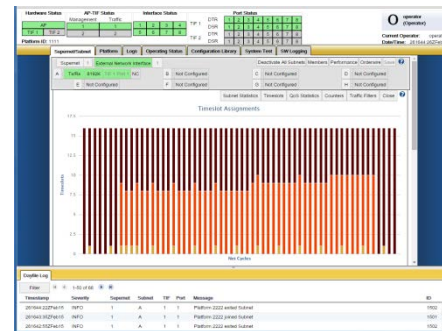


Advanced TDMA Interface Processor (ATIP)

- IP Layer-2 Ethernet bridging device
- Element of Navy Multiband Terminal (NMT)
- Supports ADNS and BMDS Networks
- Features:
 - Rack mounted COTS servers based on RT-Linux
 - Open, modular, scalable architecture
 - IPv4/IPv6 networking & QoS enhancements
 - Information Assurance & Security
 - Prioritization and Dynamic Bandwidth Allocation
 - Framing for multiple data streams
 - Adaptive Coding enhancements
 - Web based control & configuration system
 - CMMI 3 development process

Other experience

- Linux, VxWorks, GHS Integrity
- BSP, PSP, Boot loader, Radio control library
- Device Drivers – Ethernet, audio, USB, UART
- Radio Devices, Radio Control, RF Control,
- DSP modules device drivers and sample apps



SATCOM Network Simulator



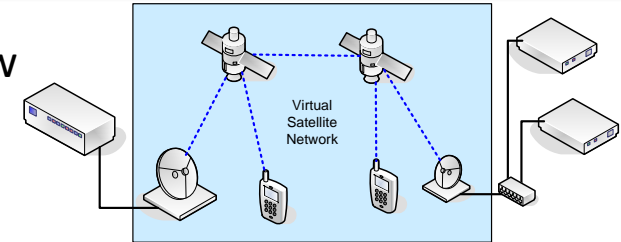
Modes & Uses

- Hardware-in-the-Loop Mode:
 - Layer-2 Verification and Validation of real hardware
 - Performance, Reliability, and Scalability metrics derived from realistic scenarios
- Offline Mode:
 - Estimate bandwidth and power requirements reliably by simulating years of operation in minutes
 - Accurately predict Capacity and Availability for planned deployments

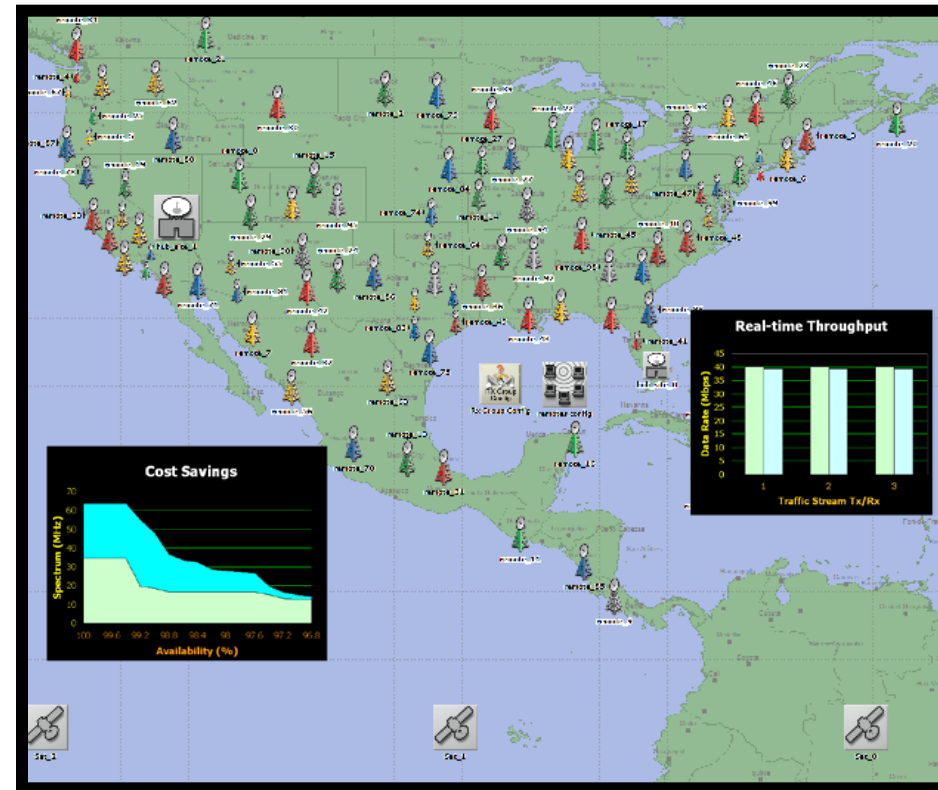
Features

- Real-time simulation of 100's of links, including satellite-to-ground, ground-to-satellite, and satellite-to-satellite communication
- Support for dynamic modulation (VCM and ACM; DVB-S2)
- Simulates location-based fade and weather effects
- Dynamic, multi-user link power budget analysis
- Windows or Linux Software solution -- runs on commodity hardware

System View



OPNET model



SDR Development Systems



Thunder-H



Thunder-L



Microburst

Range: 400 – 4000 MHz
RF BW: 40 KHz – 40 MHz
Use: Development of waveforms

Range: 30 – 1600 MHz
RF BW: 40 KHz – 40 MHz
Use: Development of waveforms

Range: 30 – 3800 MHz
RF BW: 1.5 MHz – 28 MHz
Use: Development of waveforms to deploy on Microburst SDR

DataSoft SDR platforms are fully programmable development platforms with TI GPP/DSP/Xilinx FPGAs, complete software environments with example applications for advanced waveform and IP development covering all communications bands

Features

- Affordable, **wide-band**, high performance baseband and **RF development** and test platforms with low phase noise, excellent spurious performance, fast hopping transceivers with multiple external interfaces
- All feature a 3-board system: Baseband, RF Transceiver, and FEM with Xilinx Spartan-6 FPGAs and TI DM3730 OMAP GPP/DSP
- GiGE interface for high speed connectivity from MATLAB/GNU Radio/Host directly to the WF FPGA.
- Nimbus SDK for waveform development/porting
- Probe Toolbox -- real-time multi-processor debugging tool that includes Data probe, Resource probe, Latency probe, Traffic probe, SCA Adapter probe
- Models:
 - Thunder-Low: 30 MHz – 1600 MHz
 - Thunder-High: 400 MHz – 4000 MHz
 - Microburst: 30 MHz – 3800 MHz

Applications

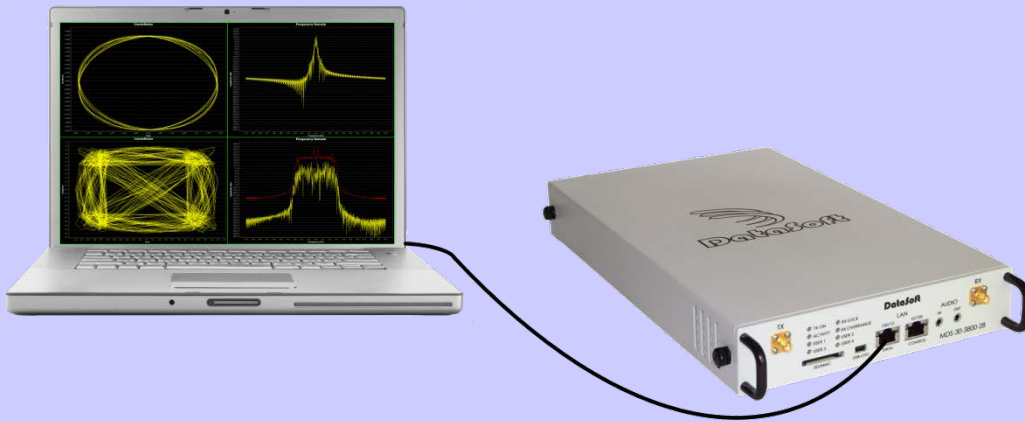
- SDR Development Platform
- Waveform & Algorithm Development
- Test automation
- Cognitive Radio, TV White Spaces, LTE
- Academic R&D & Rapid Prototyping

Probe Toolbox for SDRs



Probes for Waveform Development, Debug or Porting

Real-time debugging tool with ability to probe and excite waveform elements for waveform porting, integration or validation



Using the Probe Toolbox, the waveform developer can study critical waveform and platform traffic on multiple processors and the interaction between the processors

Probe Toolbox software is part of the Nimbus Software Development Kit provided with all DataSoft SDR platforms

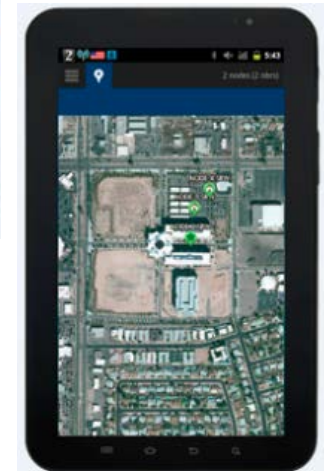
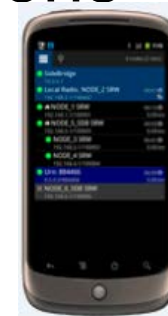
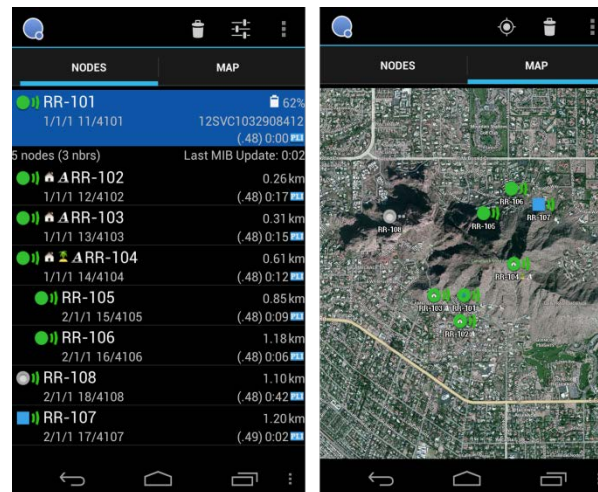
Features

- Data Probe
 - Inject or capture GPP/DSP stream data
 - Synchronize and trigger multiple probe points
 - Capture block data
 - Interface to MATLAB/Simulink
- Resource Probe
 - Memory and CPU utilization graphs
 - CPU resource detail
 - Memory peeks and pokes
- Latency Probe
 - Capture and display timestamp information with a synchronized time base across the GPP/SDP
- Traffic Probe
 - Capture and display network traffic
- SCA Adapter Probe
 - Integrated with PrismTech's Spectra Core Framework to show traffic, latency, and data in an SCA environment
- Applications
 - Validate waveform and platform data by applying probes at varying points in the GPP and DSP
 - Gather data in heterogeneous multiprocessor environment

Tactical network Android Apps



- Real-time network health & status visualization; data logging; routing functions; protocol conversion
- Partner to Samsung for KNOX secure comms
- CSfC software – in process for NSA approval for Secret & below wireless communications



Automated Testing and Compliance Verification

Automated Test Expertise



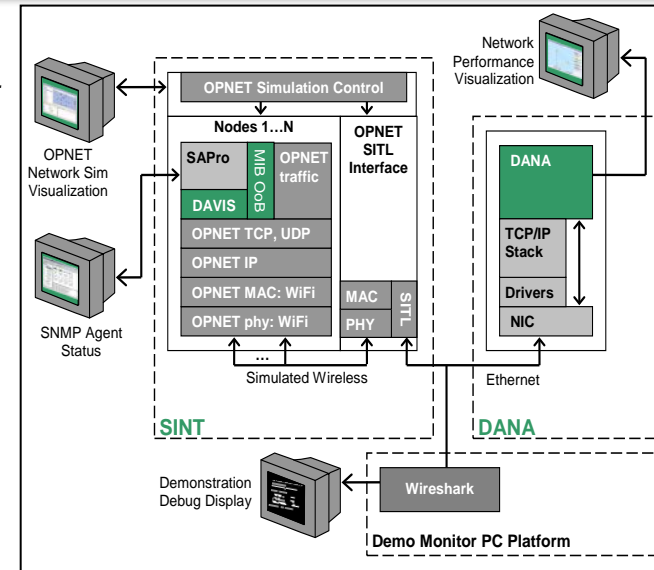
- **Simulation based Testing**

- OPNET-based test bed
- Data Collection & Analysis tools
- HW-in-the-Loop (HWIL) testing
- SW-in-the-Loop (SWIL) testing

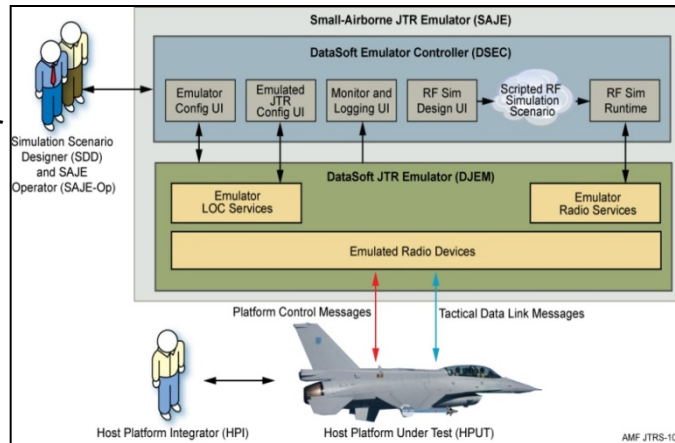
- **ATE Design & Development**

- STE design & fabrication
- PC-based control via GPIB bus
- Virtual RF Environment
- LabView and Teststand
- Data logging & analysis

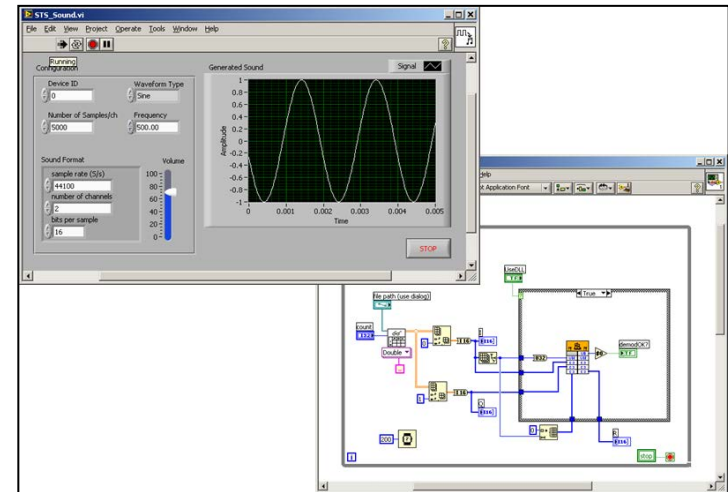
HWIL & SWIL test-bed



Radio Emulator design for JTRS AMF

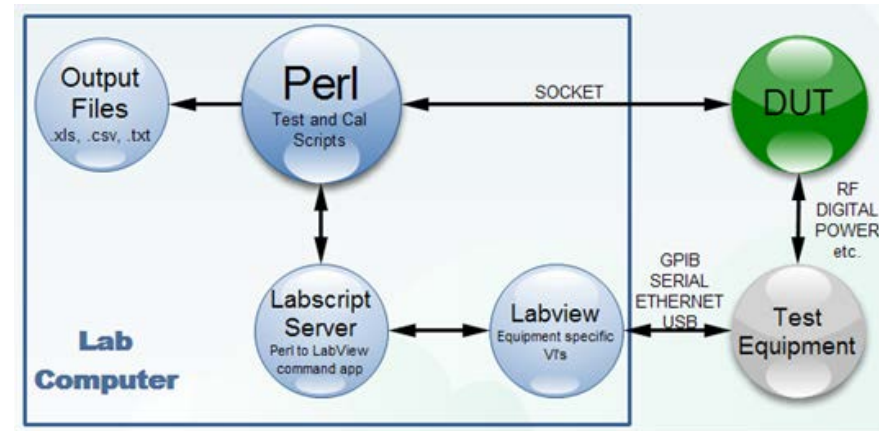


Test Automation using LabView

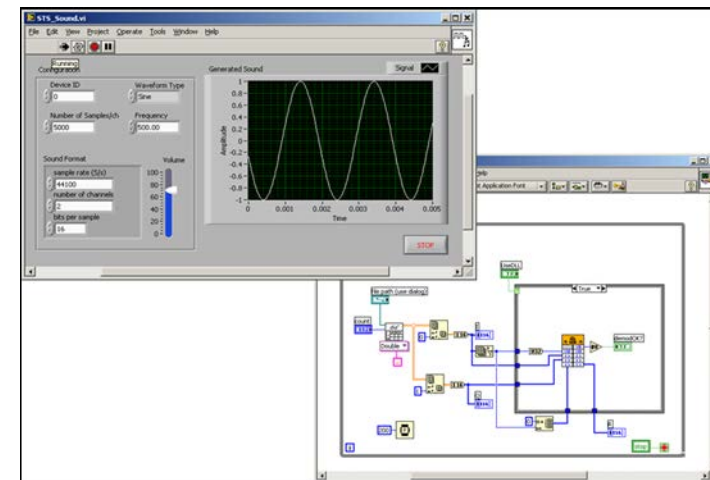


ATE for unit testing

- Combines the benefits of LabVIEW and Perl
- Allows for fast test suite development
- Easy to modify, saving time and money
- Highly configurable and eliminates needs for specialized LabVIEW licenses or experience
- Test equipment can be controlled via GPIB, serial, Ethernet or USB
- Supports numerous file formats including, .txt, .csv, .xls, .doc, databases
- Leverages specialized test functions from Perl community
- Scripts control spectrum analyzers, signal generators, temperature chambers, network analyzers, power supplies, frequency counters, phase noise meters, DMM, power meters etc.
- Example tests include TX power cal, thermal cycle measurements, harmonics, P1DB, Path Gain Cals, Phase Noise, RSSI, Spur search, etc.



LabVIEW runtime(free), GPIB controller, Perl, text editor



SATRN: Suite for network testing

Scenario Automation for Radio Network (SATRN): suite of 4 tools to test radio network

