

GENERAL DYNAMICS

C4 Systems

WANN Program Overview



Contract: FA8750-07-C-0004

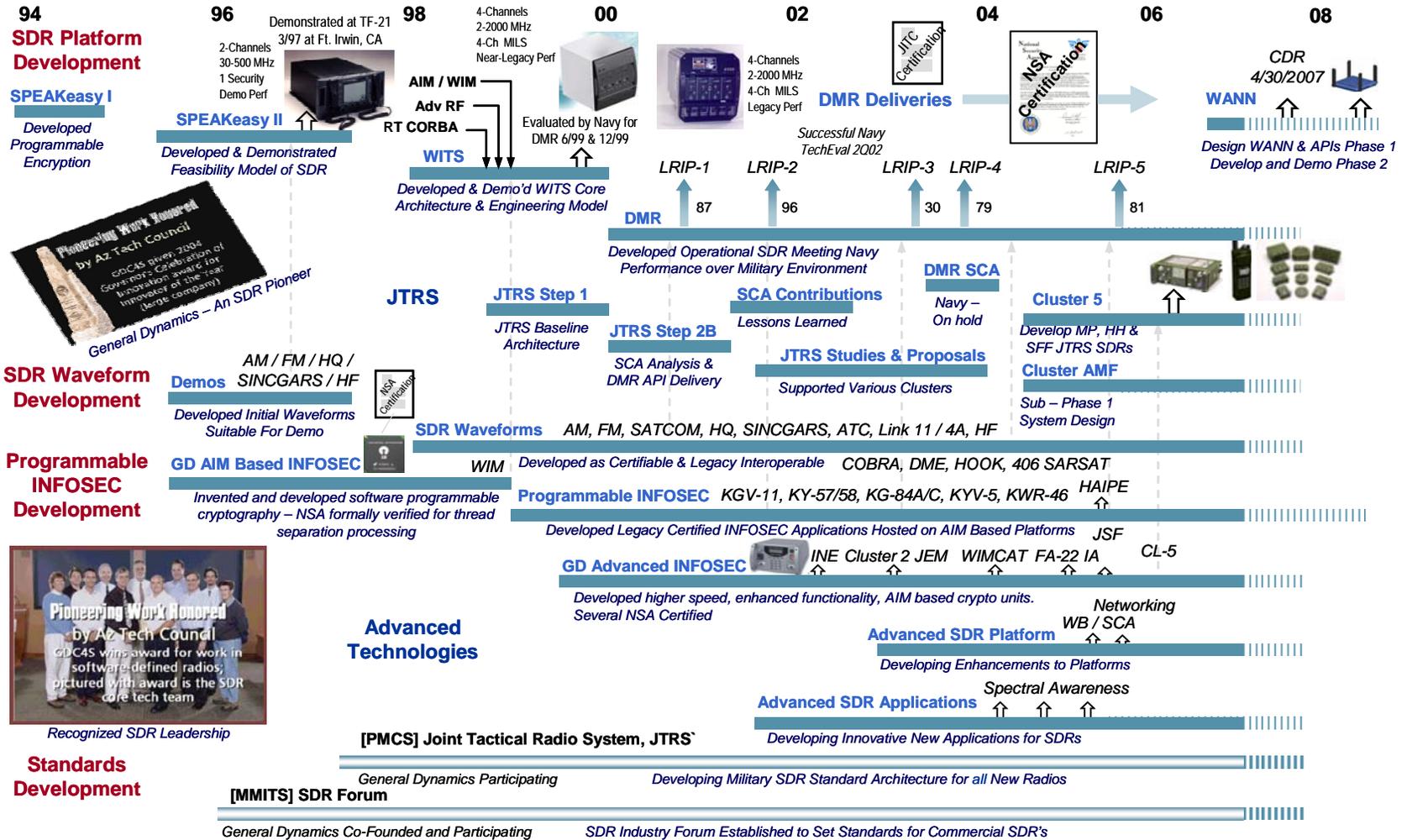


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General Dynamics Leadership in SDRs



Wireless Adaptive Network Node (WANN)

in support of WNaN and WAND

- **Vision**
 - Low-cost, dense Mesh MANETs can provide superior performance over traditional low-density Military networks, which are comprised of high-performance and high-cost communication devices
- **Challenges**
 - Node cost (per node and channel), mobility, configuration, and adaptation
 - Network density, planning, formation, topology, routing, robustness, and adaptation
- **Solution**
 - WANN – Wireless Adaptable Network Node
 - WAND – Wireless Adaptable Network Development
- **Goal**
 - Inject technology and transition to DoD programs

WANN Problem Space (Challenges)

in support of WNaN and WAND

WANN Addresses

- **Cost/Node**
 - < \$500/Node
- **Cost/Channel**
 - Must be competitive with traditional communications
- **Node Mobility**
 - Air/water/land crafts and soldiers
 - Novel cross-Layer PHY/MAC
- **Node Configuration**
 - Extensive cross-layer APIs
- **Node Adaptation**
 - Optimal adaptation, through APIs, to changing environmental conditions to achieve specified goals (Cognitive)

WAND Addresses

- **Network Density**
 - > 100,000 nodes
 - Contention, throughput, and jitter
- **Network Planning**
 - Reduced to specification of capacity & throughput
- **Network Formation**
 - Spontaneous formation without operator intervention
- **Network Topology**
 - Logical/physical layering of signaling (command/control), and bearer (data) traffic
- **Network Routing**
 - Optimized for mobile wireless networks, QoS, and data services
- **Network Robustness**
 - QoS for interactive sessions, streaming data, and finite data communications
- **Network Adaptation**
 - Spontaneous adaptation to changing network conditions

General Dynamics WANN Solution

- **WANN**

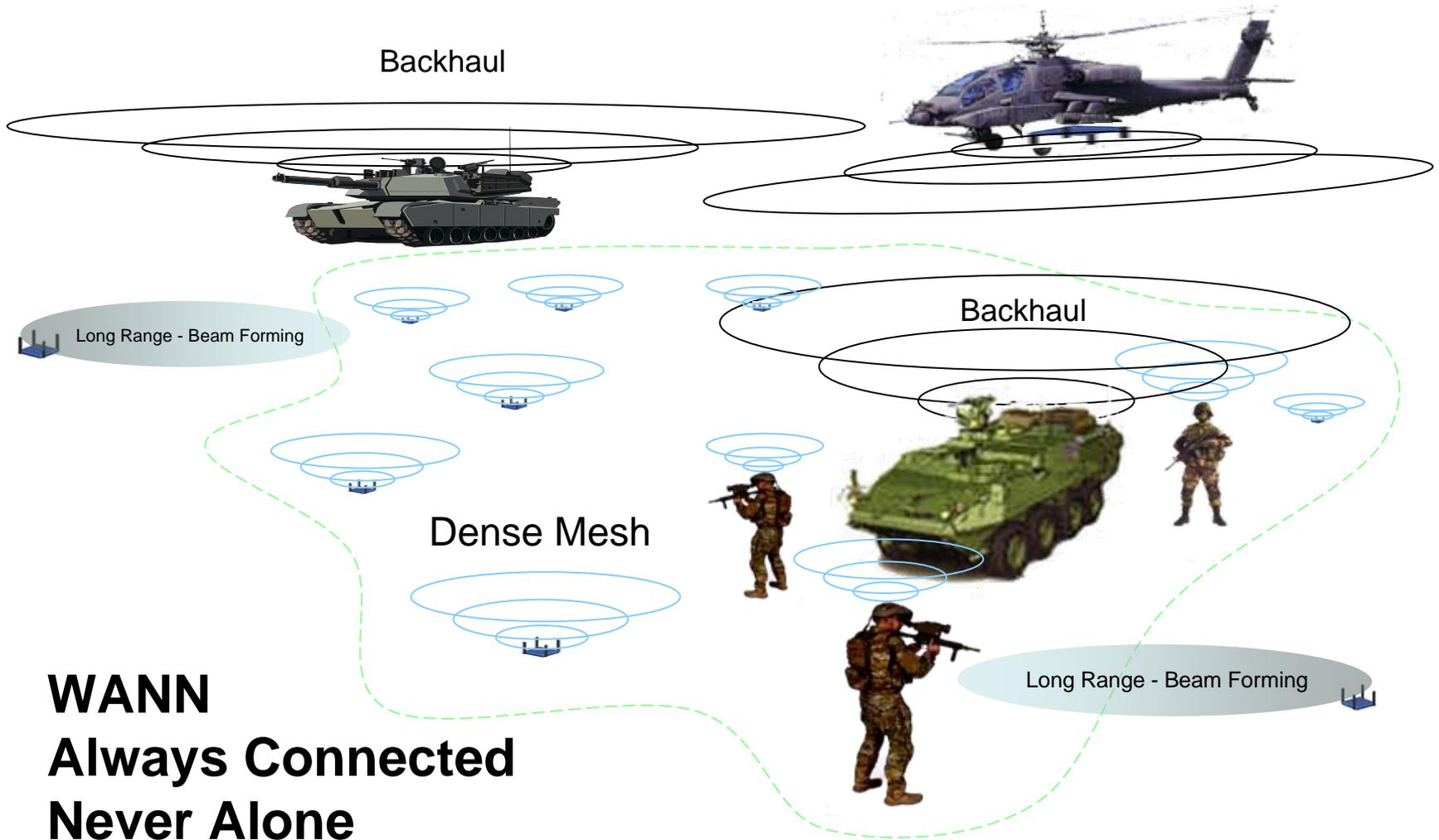
- Low cost (< \$500) to enable large-scale dense mesh MANETs
- Wideband and frequency agile (0.9 – 6 GHz) for diverse applications
- Bandwidth adjustable (100kHz -10MHz) for QoS
- RF coherent for 4x4 MIMO & beam forming
- Adjustable TX power (up to 36 dBm over 4 channels) for link & power management
- Low power for extended battery life (>10 hrs) and small form fit usage
- Software defined for optimum configurability and adaptation
- Intense processing (>30 GOPS) for demanding Network Applications
- Modular for technology insertion in a rapidly changing Network world

- **WANN Cross-Layer API**

- Extensive and extendable to enable Application, Network, and WF Development
- Provides configuration for cognitive and network protocol stacks
- Enables adaptation to rapidly changing environmental and network conditions to work around spectral issues and network congestion



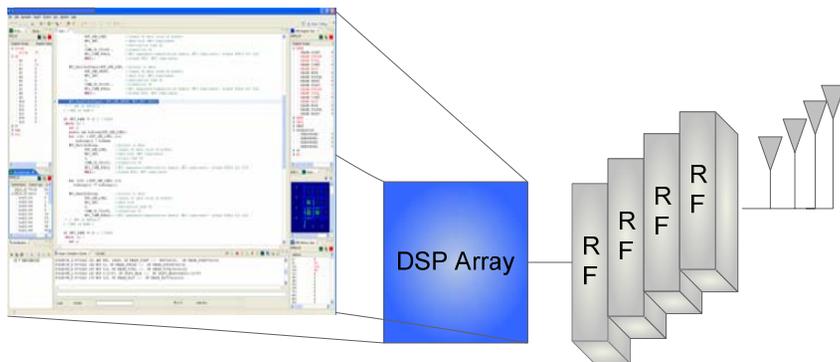
General Dynamics WANN System View



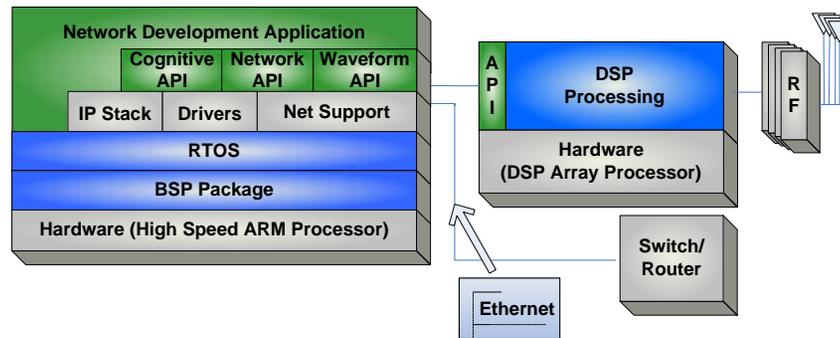
WANN
Always Connected
Never Alone

PHY/MAC/Net/Application Development

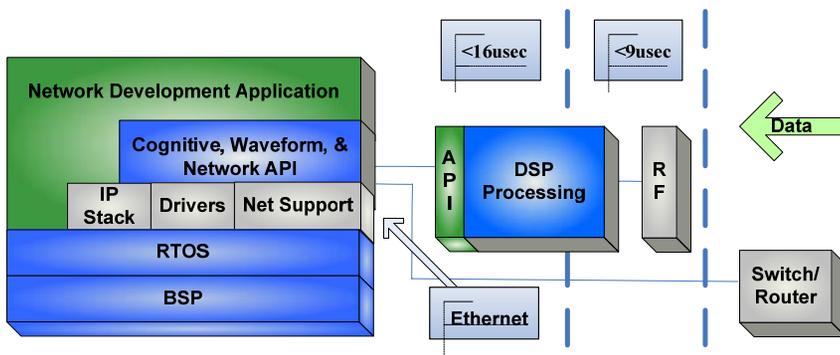
PHY/MAC Development



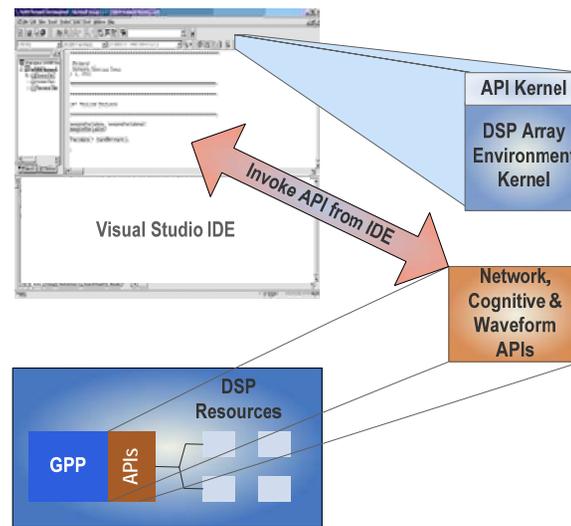
Network Development Platform



Cross-Layer API and Timing

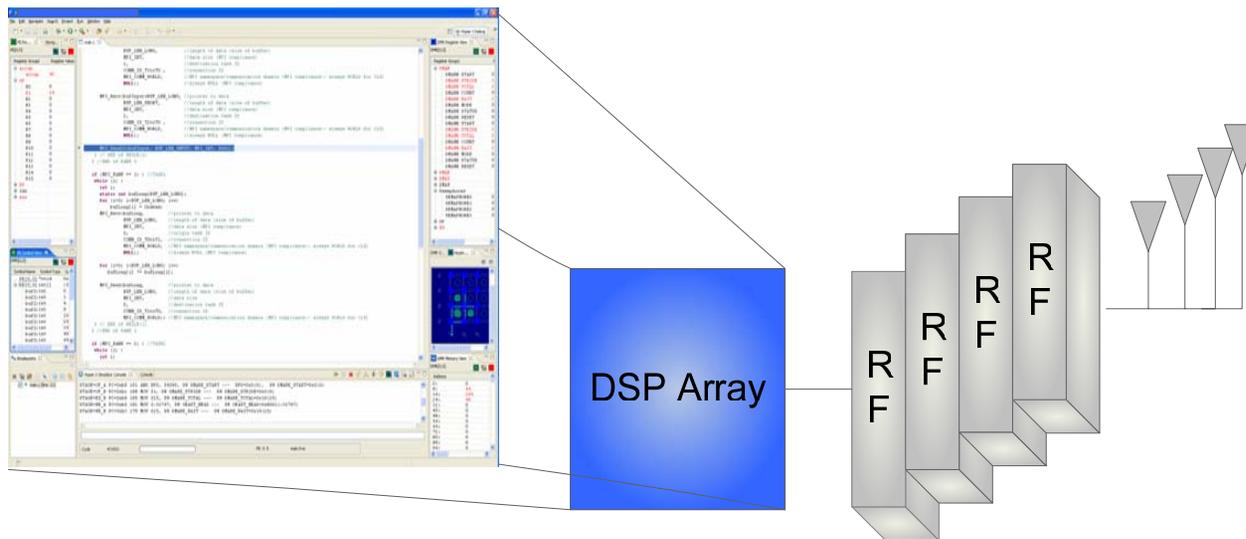


Visual Studio Network API Plug-In



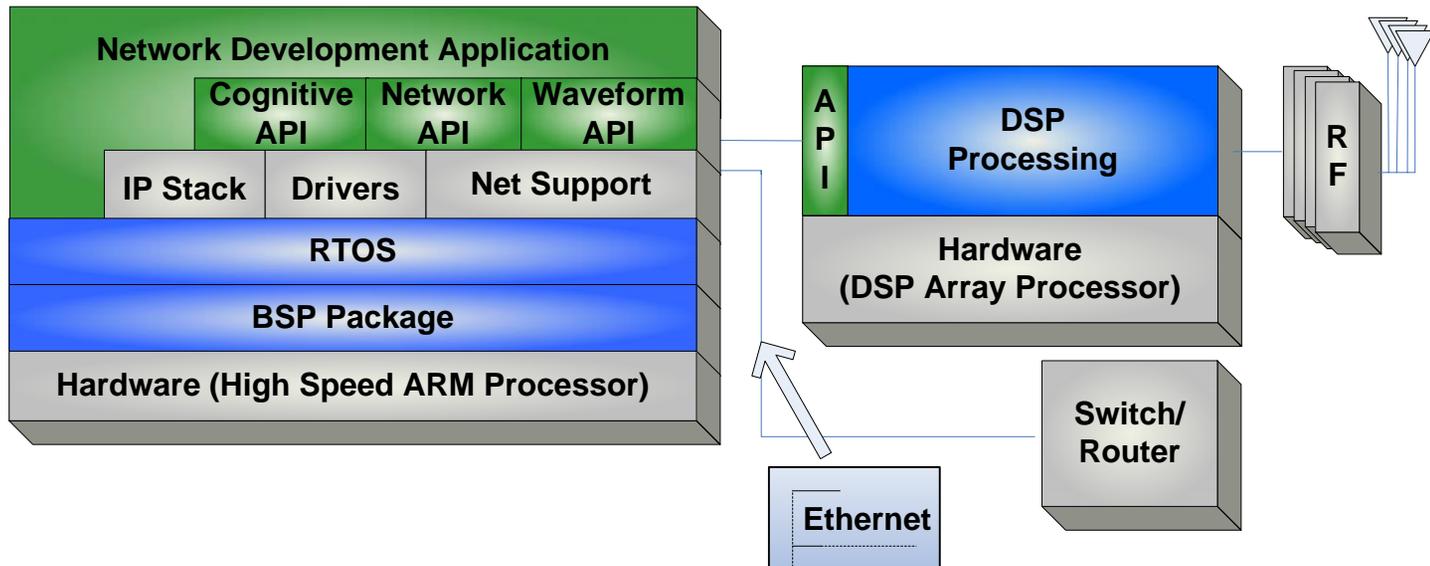
PHY/MAC Development

- **ANSI-C to support PHY/MAC portability**
 - C widely used in embedded systems market
 - Language adopted as ANSI standard in March 2000
 - No name mangling issues to resolve in regard to use with OS kernel SW or other embedded SW written in C
- **Industry Standard Cross Development Environment**
 - Windows (Microsoft) Based Integrated Development Environment (IDE)
 - Full debug capability using a clock-accurate simulator



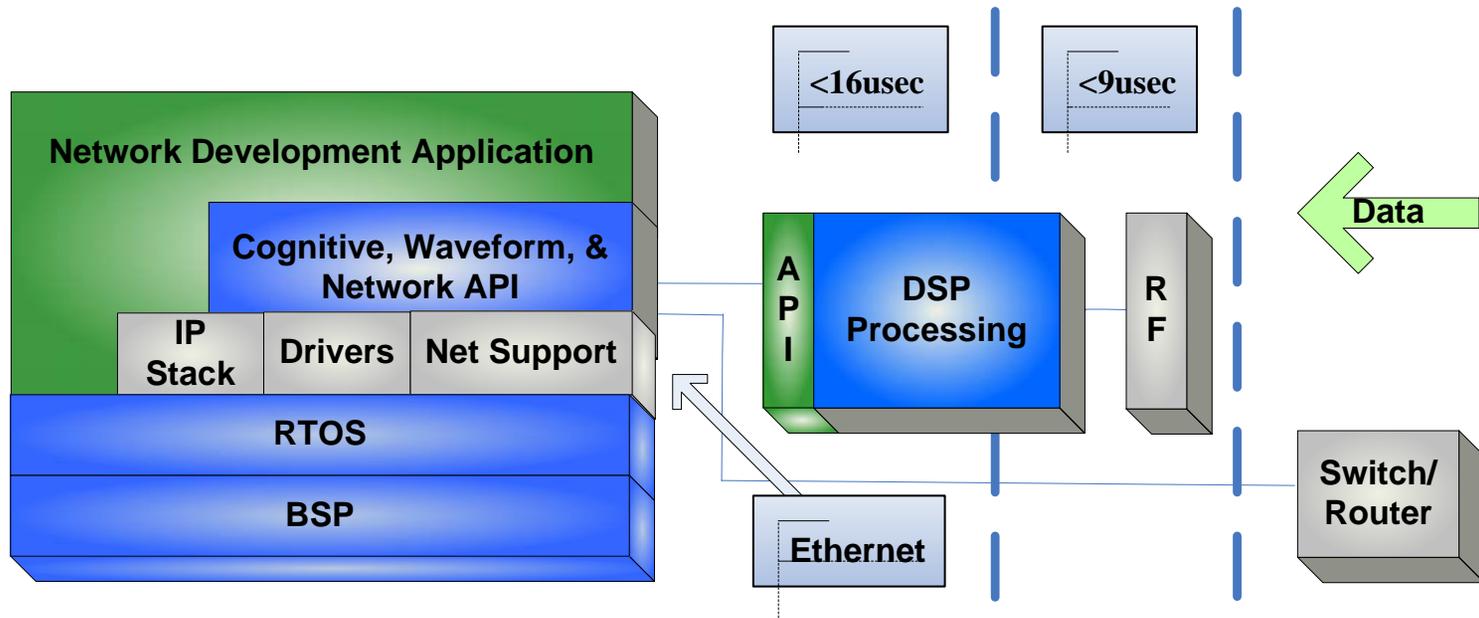
Network Development Platform

- **ANSI-C supports Network Protocol Portability**
 - C libraries compatible with Object Oriented C++ Language
 - Avoids Object Oriented Paradigm Adaptation Issues (Design Patterns)
- **Linux Compatible RTOS (LynuxWorks)**
 - Native support for Linux Applications (ELF)
 - Supports Industry Standard Development Tools
 - Increases number and use of Commercially Available Network Applications
 - Deterministic ISR Behavior (Reduces Network Jitter & Latency)



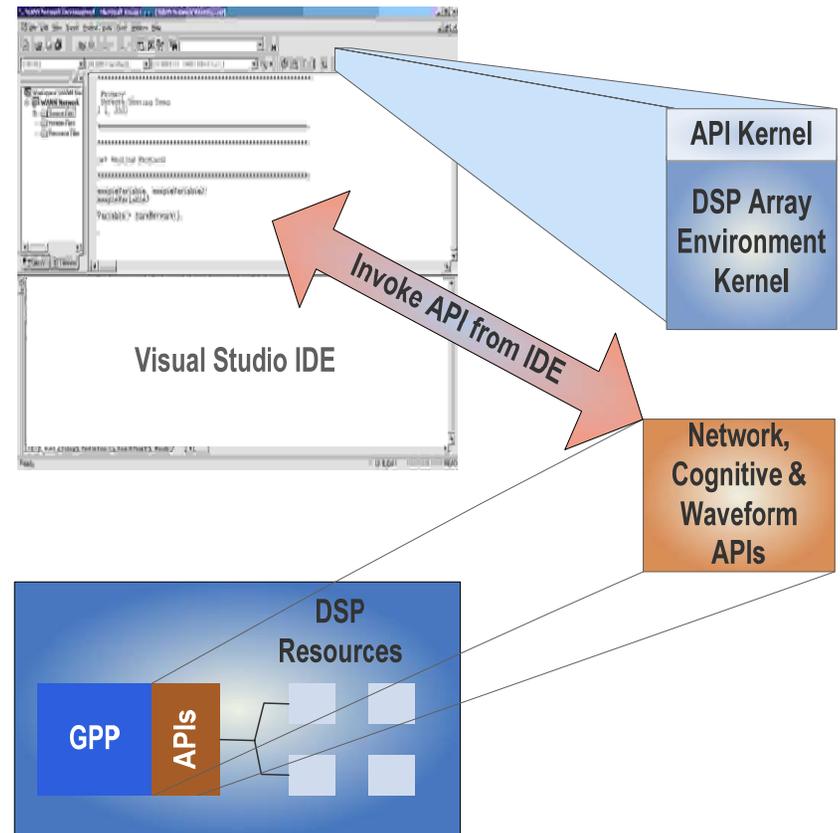
Cross-Layer API and Timing

- **Cross-Layer API designed to provide**
 - Extensive configuration of WANN Platform & WAND protocol stack
 - Optimal adaptation to changing environmental & network conditions
 - Support for demanding real-time protocol timing requirements (Layers 1 & 2)
 - Efficient use of platform resources
 - Common & mutually independent header files
 - Optimized Data Structures to reduce required memory



Visual Studio Network API Plug-In

- **Provides standard Windows based IDE (Microsoft) for Network developers**
 - API library available from within cross-development environment
 - Debug enabled through use of compile MACROS
- **Abstracts complex PHY/MAC functionality**
 - IDE collects libraries used by network during compile and Link
- **Plug-in provides Visual API Signatures and Documentation**
 - Help documentation, function signatures, use cases, and cut/paste capability



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