Above 2 GHz Common Communication System Architecture

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Presentation Overview

- Network Architecture and Mission Overview
- Challenges for above 2GHz System Architecture
- Definition of Terms
- Building an >2GHz Terminal
- Managing Diverse Requirements
- Functional Decomposition Methodology
- Example Decomposition - Waveform
- Component Validation
- Next steps

Simplified Network Architecture

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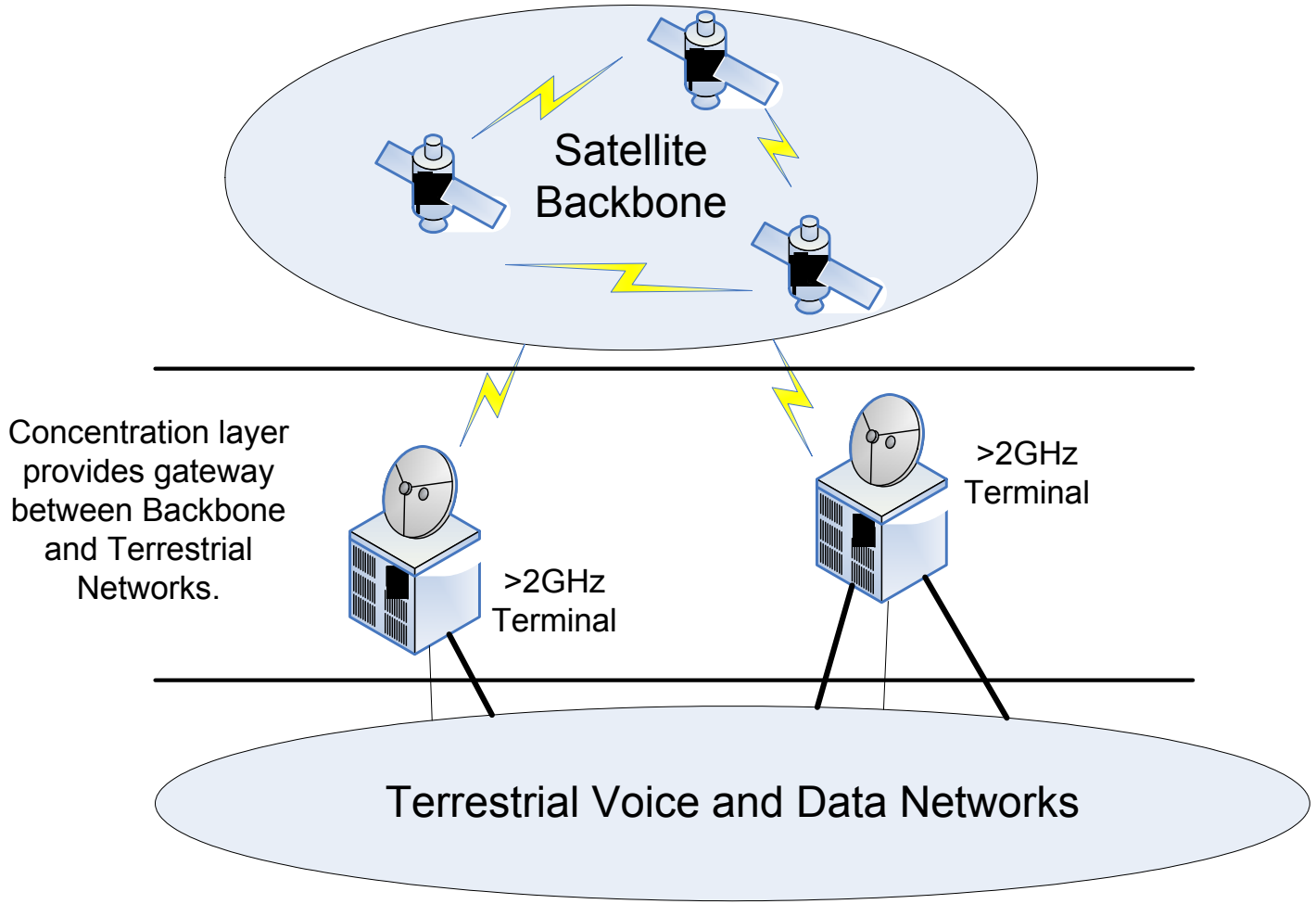

Mission Example – Remote Access

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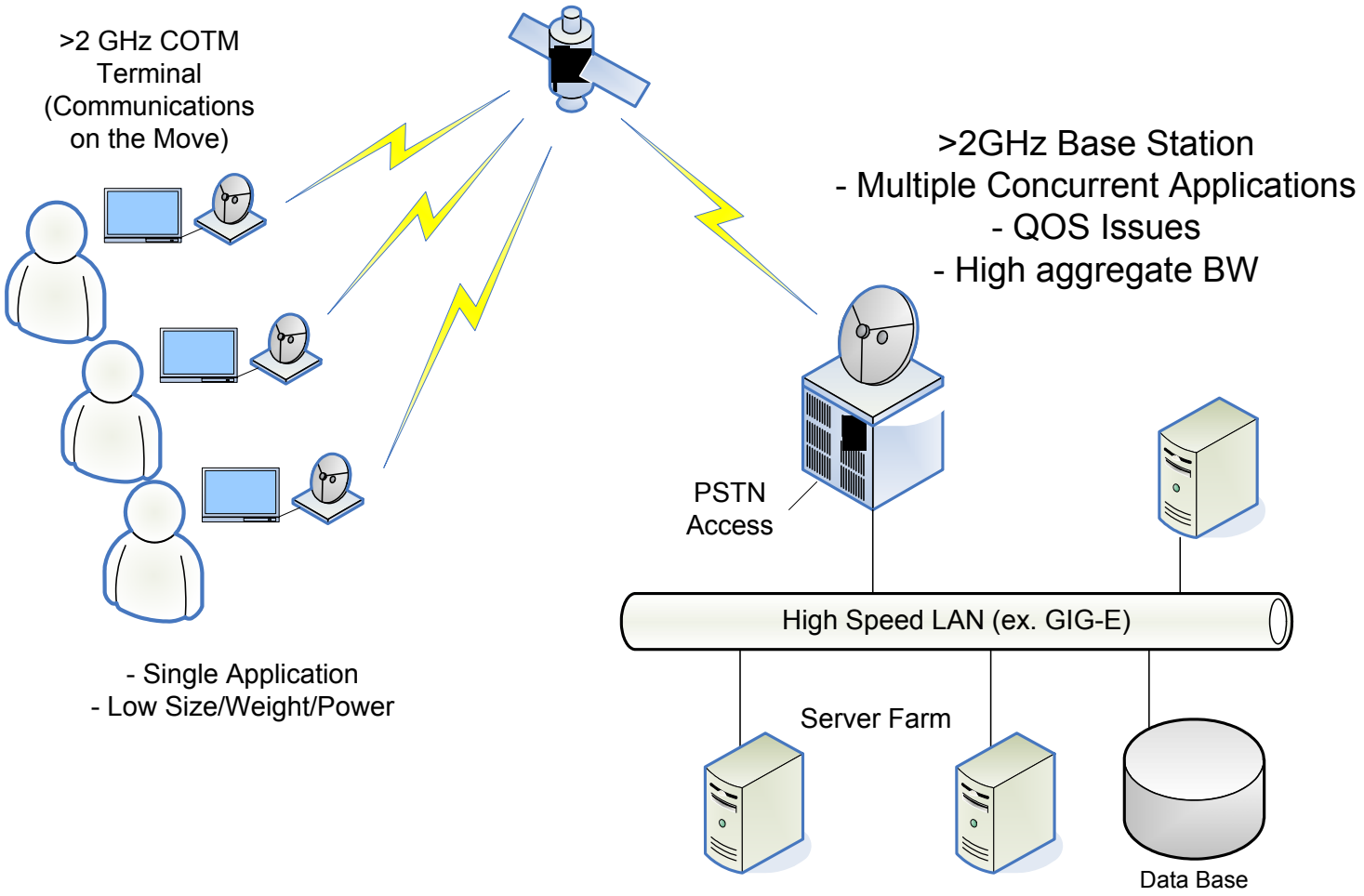


Challenges for >2GHz Architecture

- Diverse **Performance** Requirements
  - Low Data Rates to 100's Mbps (Broadband modulations requiring precision timing)
- Requires integrated HW/SW solution – a **Systems Solution**
- Diverse Service/Mission Requirements (Air Force/Navy/Army)
  - Tactical vs. Strategic
- Diverse Physical Constraints (**Size/Weight/Power**)(SWAP)
- Diverse Antenna Requirements
- Diverse **Mobility**/Tracking Requirements
  - Communication-on-the-move to Stationary, narrow beamwidths
- Diverse Security Requirements
- Complex SATCOM waveforms
- Simultaneous Multiband Capability

➢Top Priority on Extensible & Scalable

Working Definitions

- **Architecture**
  - "The structure of components, their relationships, and the principles and guidelines governing their design and evolution over time"*
- **Waveform**
  - The set of all HW/SW components required to implement the functions associated with interfacing to the Satellite(s).
- **Network**
  - All HW/SW components required to implement the functions associated with interfacing to the 'Baseband' (Example EIA-422, Ethernet, T1)
- **Platform**
  - All HW and SW components required to host/support a waveform and network to create a radio (e.g., BIT/BITE, antennas, etc.)
- **Control**
  - Software associated with the external control and monitoring of the radio (UI, SNMP etc.)

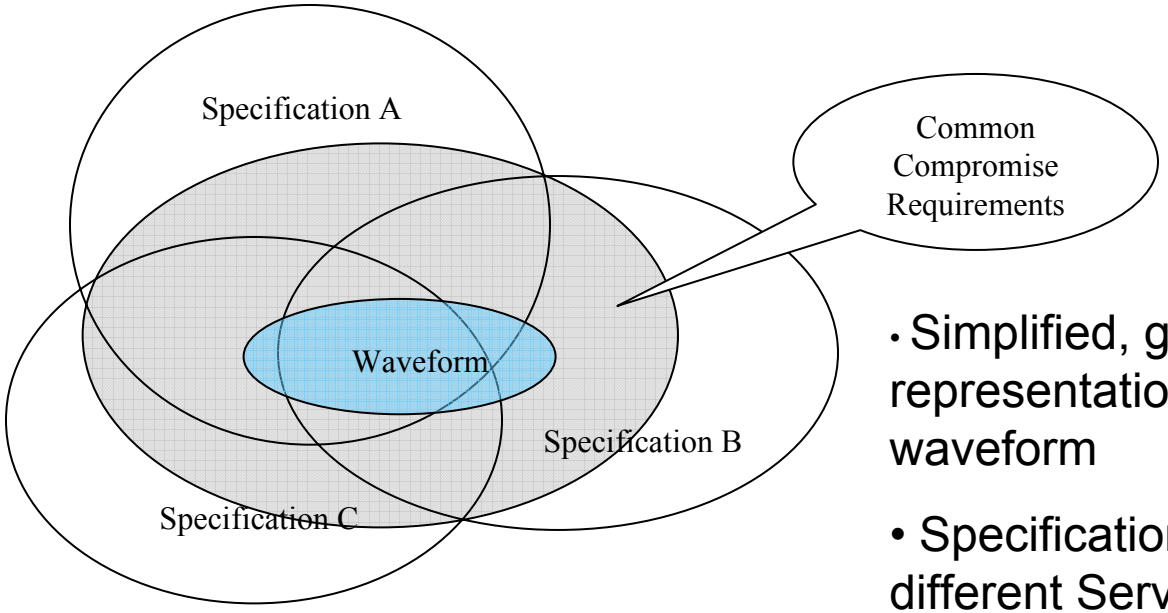
➢Terminal = Waveform + Network + Platform + Control

*IEEE STD 610.12, as extended by the Integrated Architecture Panel (IAP) of the C4ISR Integration Task Force (ITF)

Building a Terminal

- Old Approach
  - Terminal specified as a monolithic entity for every Service
  - Specifications optimized for service capability and mission requirements
  - Emphasis on custom solution
- New Approach
  - Terminal specified in terms of components – Platform, Waveform, Network, and Control
  - Component requirements support terminal requirements
  - Components are selected from libraries to satisfy functional and non-functional requirements (Portability/Extensibility/Scalability/Reusability)
  - The Terminal is built from derived platform, waveform, network, and control components

Managing Diverse Requirements



- Simplified, generic requirements representation limited to platform and waveform
- Specifications A, B, and C represent different Service Terminal requirements
- Assume only one Waveform to keep picture simple
- Intersection of requirements is primarily due to Waveform
- Entire Waveform is not required by most terminal specifications

➢**Platform and Waveform Must be Carefully and Precisely Defined as Separate Entities Since Platform Can Be Reconfigured to Support Different Waveforms**

Decomposition Rules

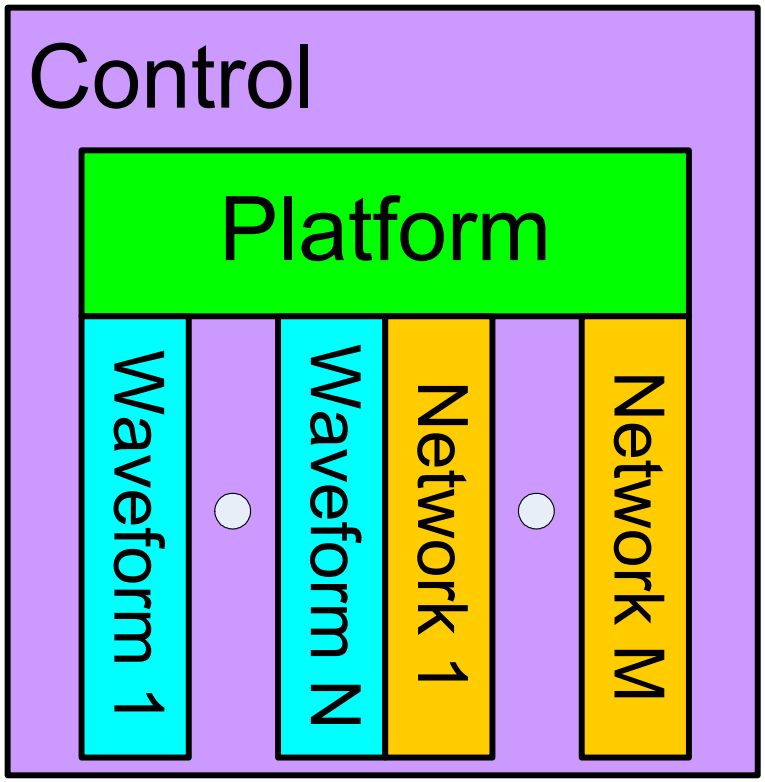
- Assign requirements to functions
- Assign functions to components
- Identify dependence of components on categories of requirements
  - Platform, Waveform, Network, Control
- Reduce dependencies to single category
  - Develop components with capabilities that reduce dependencies (example - A tracking algorithm that works for a platform under motion should also work for a stationary platform!)
  - Push multiple dependency functions to lowest decomposition level to separate dependencies
    - Want common controls for platform, waveform, network, control or performance dependent objects

Decomposition Rules - Cont

- Decompose to primitive component capabilities
  - Uses building block APIs
  - Enables portability of components
  - Enables flexibility to meet specific terminal requirements

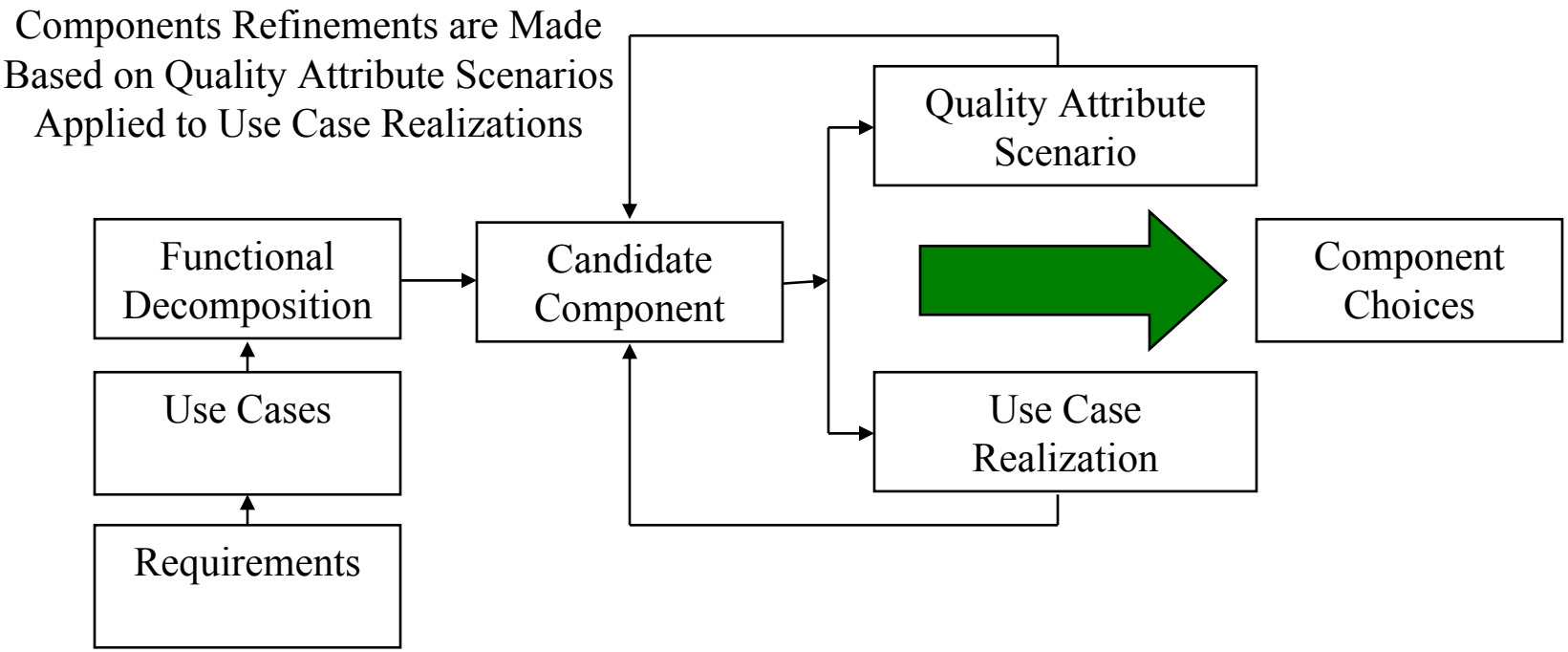
Building a Terminal From Components

- The Terminal is built from derived platform, waveform, network, and control components
  - Terminal components are assembled from SCA waveform, service, and device components



Validating Component Selection

- Component Development and Validation Methodology



➢**Selection of Components is an Iterative Process**

Functional Decomposition Agreement

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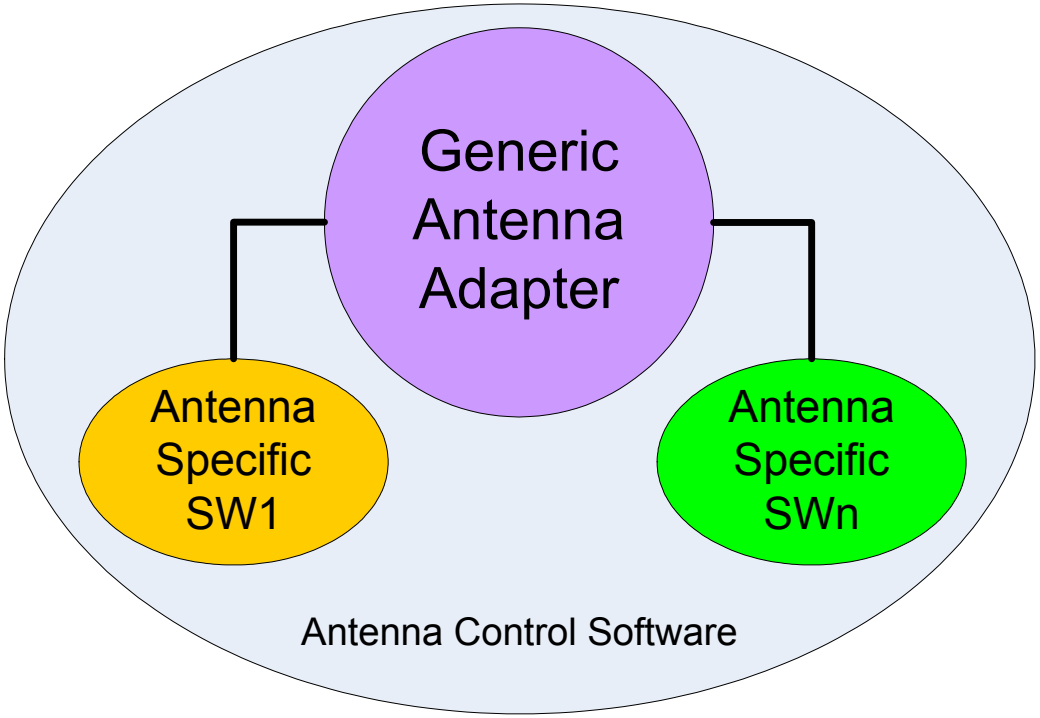
- Agreement on Common Decomposition Across Platform, Network, Control and Waveform is Vital
  - Maximizes portability – minimizes porting costs
  - JTRS application SW is being developed using an evolutionary model to converge to a common decomposition
  - Approach avoids >2GHz application SW from being developed many times
- Focus on broad definition of Re-Use
  - Component Requirements
  - Component Designs
  - Interface Specifications
  - Component Implementations (HW/SW)
  - Test Plans
  - Test Cases
  - Test Procedures

General Terminal Component Design

- Terminal components should abstract the uniqueness of subcomponents
  - For example, a physical radio may contain 2 different antenna types, the antenna terminal component should make this transparent



Next Steps

- Raytheon has been working with industry to define standards for below 2 GHz Software Defined Radios
- Raytheon is contributing to the enhancement and extension of those standards to above 2 GHz capabilities
  - Providing comments to OMG RFIs and RFPs
  - Working on providing recommendations for additional and enhanced facilities
- Continued efforts to refine optimal component sets
- Work to extend validation methods and techniques
  - Develop simulation and common use case models