Espre'®

Communications and Network System Design Software

Background

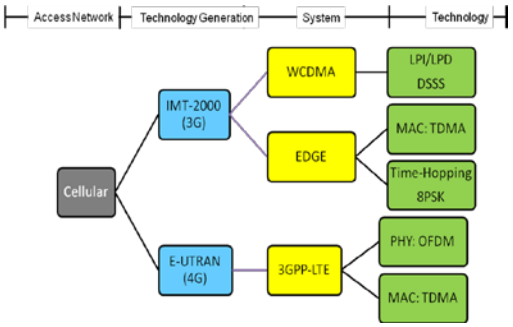
In order to develop, expand and maintain the underlying equipment and infrastructure that comprise today's networks, designers and manufacturers need state of the art communications systems design tools and software which allow them to bring new communications capabilities and technologies to market faster, cheaper, and with optimal great results. To address this need, TCI has created Espre', a novel network and communications design software application and development environment.

Technology Overview

Espre'® is TCI's advanced network and communications design, prototyping, and simulation platform for communications components, systems, and network design. The Espre' software includes the ability to model and simulate a significant variety of communication systems and networks using an advanced, full featured and robust tool environment with a rich, easy to use interface. Unlike traditional communications and network system tools, Espre' is a complete, fully integrated tool environment that combines the key elements and layers of the communications system, from antenna and signal capture through filtering, baseband processing, packetization, transport and backhaul for a wide variety of terrestrial, wireless and space-based communications environments and delivery systems.

Benefits

Using Espre' in a communications system design flow and methodology will shorten project cycle time including planning and implementation, while adding new capabilities and features, providing greater visibility into the overall system and accompanying results, and improving overall performance and robustness. Espre' built-in standard tool integration capability allows designers to leverage and protect investments in existing design tools and libraries such as MATLAB/ Simulink and OPNET, as well as adding new, custom blocks into the platform.



Cellular Radio Technology Mapping

Features and Design Capabilities

- System architecture and organization
- Physical layer design and attributes
  - *Channel sensing, estimation and detection*
  - *Coding and modulation*
  - *Equalization*
  - *Interleaving*
  - *Adaptive filtering*
  - *Amplification*
  - *Timing and synchronization*
- MIMO and cooperative networking
- Multiple access systems
- Dynamic spectrum access
- Adaptive systems
- Array processing
- Interference detection and avoidance
- Multidimensional signal processing
- RF distortion analysis
- Spectrum management
- Cognitive radio design

Communications Services

Network protocols:

- *Packet and circuit switching*
- *Asynch, synch, and isochronous traffic*
- *TCP / IP and Bundle protocols*
- *Hybrid ARQ*
- *Manet (DSR, AODV, OLSR, BP)*
- *Voice, Data, Video applications and transports*

Commercial radio system library:

- *Wi-Fi, Bluetooth, Ultrawideband*
- *CDMA / WCDMA / UMTS / EDGE / GSM*
- *WiMax / 3GPP / LTE*

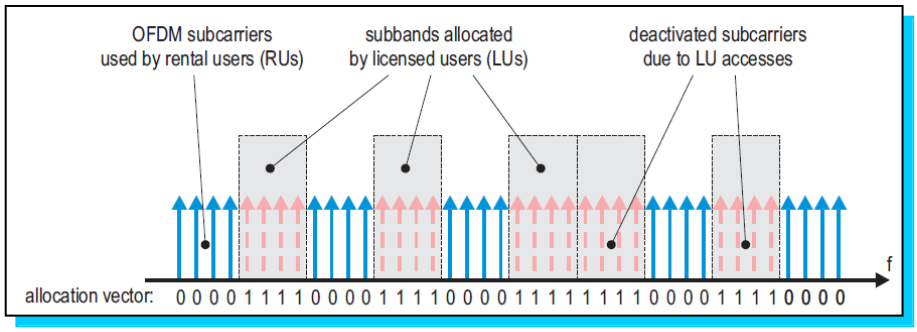
Modulation and coding systems:

- *OFDM / OFDMA / M-ary PSK/QAM*
- *Single carrier (SC) / M-ary PSK/QAM*
- *SC-FDMA / M-ary PSK/QAM*
- *TCM / multi-level coding*
- *Convolutional Codes/Reed Solomon Codes*
- *Bit & Symbol Interleaved coding*
- *Turbo codes / LDPC*
- *Space-Time Block Coding*
- *Spatial Precoding/Codebook Decoding*

Example Applications using Espre'

- Study and analysis of multi-tier heterogeneous networking systems utilizing both commercial and military radio access across terrestrial, airborne, and space-based equipment including Wi-Fi/802.11, 3G cellular, 802.16, WNW, SRW, HNW and others

- Perform trade off analysis of cooperative approaches to spectrum allocation for primary and secondary users such as property rights, dynamic allocation, overlay, and underlay techniques



Analyze Approaches to Dynamic Spectrum Access

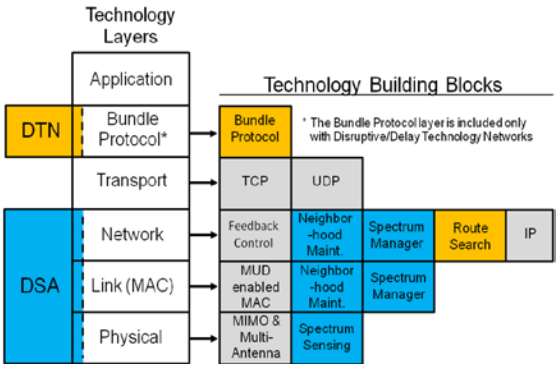
- Selection and integration of various receive antenna options and designs including diversity, directionality, and MIMO. Studying the system behavior and performance

- Mapping of access techniques to various waveforms including TDMA, CDMA, OFDM, single carrier and other modulation technologies across diverse radio services

- Design, simulation, and prototyping of cognitive radio access systems including channel sensing, carrier and modulation detect, demodulation, decoding, synchronization, packet detection, media access control etc.

- Create, simulate and prototype next generation waveforms including dynamic spectrum access in order to test for optimal configurations given different use cases and environments, understand system performance and determine constraints

- Prototyping, modeling and deployment consideration analysis for emerging sensor and grid technology applications / networks



DSA Building Blocks

About TCI

Terry Consultants, Inc (TCI), founded by Dr. John Terry in 2001, specializes in design, modeling, and implementation of advanced communications technology, ranging from comprehensive studies for the US government on dynamic spectrum access, to emerging technologies such as cognitive radios, MIMO technology, and advanced waveform protocols for the future military programs. TCI brings a highly innovative design team with over 50 issued/pending patents along with 70+ years of research, engineering, inventions, and design in signal processing and communications systems and services in both commercial and defense sectors. The team has contributed more than 100 contributions to key industry conferences, journals, and standards and Dr. Terry has co-authored a book in wireless communications.