

### Application Testing Over Wireless Networks

#### Overview

iTrinegy's powerful, multi-path, multi-segment network emulators, INE Ultra and INE Enterprise, are well established with the leading players in testing of wireless networked application performance in the following sectors:

- ◆ Emergency Services
- ◆ Government
- ◆ Military
- ◆ Oil & Gas/Exploration
- ◆ Telecoms / Mobile Network Providers

A major plus for these organizations is the ability to utilize the **iTrinegy INE Wireless & Satellite Emulation Module** to quickly create a wide range of highly realistic wireless IP-based network environments, in which to test the performance of both voice and data applications.

This optional module is not limited to the creation of industry-standard networks such as mobile 2G, 3G, 4G/LTE or WiMax environments but can be used to simulate ad-hoc experimental networks such as might be required by the military and government research establishments or satellite-based networks where TDMA or other channel access methods (see below) are frequently deployed to manage data traffic.

#### Fully Configurable Wireless & Satellite Networks

One of the unique features that the INE Wireless & Satellite Module provides is a concept of a shared radio network which has the ability to create a range of wireless channel access methods including:

- ◆ Wireless Token Ring Protocol (WTRP)
- ◆ Time Division Multiple Access (TDMA)
- ◆ Code Division Multiple Access (CDMA)
- ◆ Carrier Service Multiple Access with Collision Avoidance (CSMA/CA)
- ◆ Half-Duplex / Walkie-Talkie
- ◆ A fully customizable time slicing method



*The optional Wireless & Satellite Module is available on iTrinegy's INE Ultra and INE Enterprise network emulator models.*

#### Discrete controls are method dependent and include:

- ◆ Maximum Continuous Transmission Times (MCTT) i.e. how long a device/station/node can transit before being forced to terminate the sending of data.
- ◆ Idle Time Outs i.e. Finish on Transmission where the connection is closed once data or voice packets have been sent
- ◆ Fragmentation i.e. the breaking up of packets in order to enable them to fit into the allocated time slot

Together, these correctly mimic real world networks, as there can be only one transmitter operating at any given time on a given frequency and so ensure the realistic nature of the test.

The sections below outline the main differences between the more commonly deployed channel access methods. These can all be emulated using the INE Wireless & Satellite Emulation Module.

#### Wireless Token Ring Protocol (WTRP)

The Token Ring model involves the concept that the only person or device "holding the token" has permission to transmit at that time. Others must wait until the token is handed to them when they will be allowed to communicate. The token is typically transferred in a "Round Robin" fashion to ensure everyone has a fair opportunity to transmit and time limits can be set for how long each individual is allowed to hold the token.

## Time Division Multiple Access (TDMA)

TDMA adopts a similar approach to Token Ring with each station/node being allocated a time slot in which to transmit. It works by dividing the signal into different time slots so that multiple users can share the same frequency channel. Each station transmits in rapid succession, one after the other, each using its own time slot. TDMA is frequently used in **Satellite networks including VSAT**.

## Code Division Multiple Access (CDMA)

CDMA does not work by allocating time slots. Instead, it assigns a particular set of users a shared code that only allows them to communicate with one another. Users on the network who do not know what the code is will not be able to communicate with members of the first group. However, multiple groups of users, each with their own special code can communicate simultaneously over a single channel as the channel is divided into the various different codes. CDMA has been likened to having several different groups of people, each speaking different languages and all of them talking at the same time. Only those people speaking the same language will have the ability to understand each other and they will filter out the other languages as noise to be ignored.

## Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)

CSMA/CA deploys the principles of "sense before transmit" or "listen before talk" which involves listening on the channel and if it is found to be idle, the sender transmits the first packet in the queue. If the channel is busy, the sender will wait until the current transmission is over and then applies a delay for a random interval in order to reduce the possibility of a collision with other traffic on the channel.

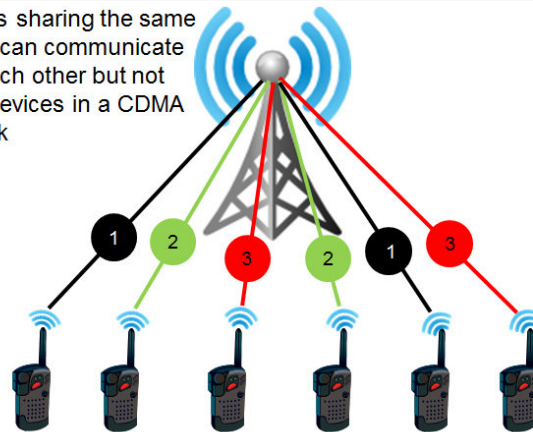
Unlike wired networks, where Collision Detection is possible, wireless networks cannot directly detect collisions so Collision Avoidance is offered as an alternative.

## Repeatable, Consistent and Controllable IP Network Emulation

The issue in any real-world network including wireless/satellite is that the test environment is unstable and uncontrollable and will take on the current characteristics of the environment where the test is located e.g. random wireless interferences will impact the test but cannot easily be repeated to order. Similarly, bad weather can affect a satellite network test and again, it is almost impossible to replicate this to order.

By using the wired test environment of an iTrinegy Network Emulator it is easy to set up the desired wireless & satellite network characteristics, including the network type i.e. TDMA/CDMA/CSMA-CA etc., that you wish to reproduce, while ensuring unwanted or random impairments do not affect the validity of the test. In short, you can apply any impairments in a consistent and controllable manner.

Devices sharing the same "code" can communicate with each other but not other devices in a CDMA network



*iTrinegy Network Emulators can replicate a wide variety of shared wireless environments including CDMA*

This allows thorough testing of applications and protocols in any of the target wireless or satellite network environments, including the ability to stress the applications by setting network characteristics to the poorest settings observed in the field. As a result, you can be confident that the application under test will work as expected when deployed in the real world.

INE Ultra & INE Enterprise deploy the concept of Virtual Interfaces (VIs) to enable you create multiple network segments simultaneously which can be combined together to create complex network links that applications could encounter when deployed in the field. Thus multi-hop and multipath network emulation is straightforward.

iTrinegy's INE Wireless & Satellite Module has, to date, been used to verify the performance of applications in a wide variety of network environments including:

- ◆ Testing video delivery over 2G and 3G mobile phone networks
- ◆ Testing the control of UAVs
- ◆ Testing battlefield command and control systems delivered via VSAT satellite links
- ◆ Testing battlefield systems including aircraft-to-aircraft, aircraft-to-vehicle and aircraft-to-infantry communications, both as standalone links and as a fully integrated environment
- ◆ Testing of field medical diagnostic systems



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