JVC KENWOOD

Private MESH Video Network

A JVC White Paper

MOBILE/REMOTE MAJOR EVENT LIVE TELEVISION COVERAGE

GOLF – SPORTS – CONVENTIONS – EVENTS – FIRST RESPONDERS – IP/ENG

JVC Private MESH Wireless Network Solutions:

JVC's new Networking Technology for TV Broadcasters is the future of "first mile" contribution for LIVE Remote/Mobile Events, built upon the wireless networking technologies of MANET, COFDM and MIMO.

A JVC Professional Video Division White Paper issued for NAB-2015

http://pro.jvc.com

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NOTE: This White Paper has been authored and produced by Tore B. Nordahl/nordahl.tv LLC on behalf of JVC Professional Video, a Division of JVCKENWOOD USA Corporation. Readers are encouraged to contact other sources of information to obtain points of view and analysis other than those presented and concluded herein.

The Next BIG Thing in LIVE Wireless Backhaul

The need for excellence in video quality and the ongoing pursuit to lead the competition with **First On-Air & First On-Line** are two very important drivers in the TV Broadcast News and Sports/Events markets (and in some other professional Digital Media segments), to reliably deliver timely and compelling LIVE and Real-time content in the quest for maximum audience ratings and long term financial success. Although content is still king, particularly in the TV News and Sports business, success today is not obtained without pristine HD image acquisition in a production environment of efficient work flow capable of LIVE delivery and streaming multiple formats for viewing HD on the three primary screens of Smartphone, Tablet/PC and on Flat Screen TVs. Just as HD acquisition, production and delivery have now been mastered by the TV Broadcasters and by most other professional TV segments, another "TV twilight zone" is upon us, as the migration from **HD to 4K-UHD** is building steam but mostly in high end TV Episodic production and in OTT delivery like the Netflix offering. **But, realistically, there will be years before the TV Broadcast business turn to 4K-UHD in any major way. HD will be their native format for a long time, from acquisition to delivery.**

So, what is The Next BIG Thing in LIVE Wireless Backhaul?

Replace/Augment miles of cabling with wireless connections at Remote Event & Stadium Locations, while providing higher HD quality from a larger quantity of roaming HD cameras

Yes, we are targeting Golf Courses, Sports Stadiums and Arenas, and Convention Halls, in addition to large venue Concerts, where a relatively large number of HD video cameras are roaming as well as being stationary, for a relatively short period of time, in active use for several days (Golf coverage) to as little as one day (Pro-Football). Television Production Trucks move in, temporarily install their own cabling (unless they can use the permanently stadium installed cables), hook up their stationary HD cameras and a few roaming HD cameras, wired or wireless, and after a day of televised sports, they reverse the process by packing up whatever cabling they laid down.

The new **JVC Private MESH Network Solutions** seek to make this process much more efficient and reliable, thereby saving time, labor and money, by offering a new Private Wireless Networking approach to major Mobile/Remote LIVE television coverage.

The JVC Private Wireless MESH Network is highly portable and very flexible.

Private vs. Public Network & Internet

JVC is the market leader in delivering high performing cost effective HD-ENG camcorders to TV stations, with many TV stations relying on JVC's camcorder-embedded wireless IP-based LIVE backhaul over 4G-LTE (broadband cellular, Verizon and AT&T) and WiFi Hotspots. These are "public networks" where the TV station is not able to control the quality or the reliability. And in some locations the service may not be available. Other manufacturers have introduced "bonded 4G-LTE backhaul", where two or more parallel 4G connections are used to increase the "usability". Also, any 4G-LTE wireless LIVE backhaul is eventually routed over the (public) wired Internet, where the TV station is again not able to control the quality or the reliability.

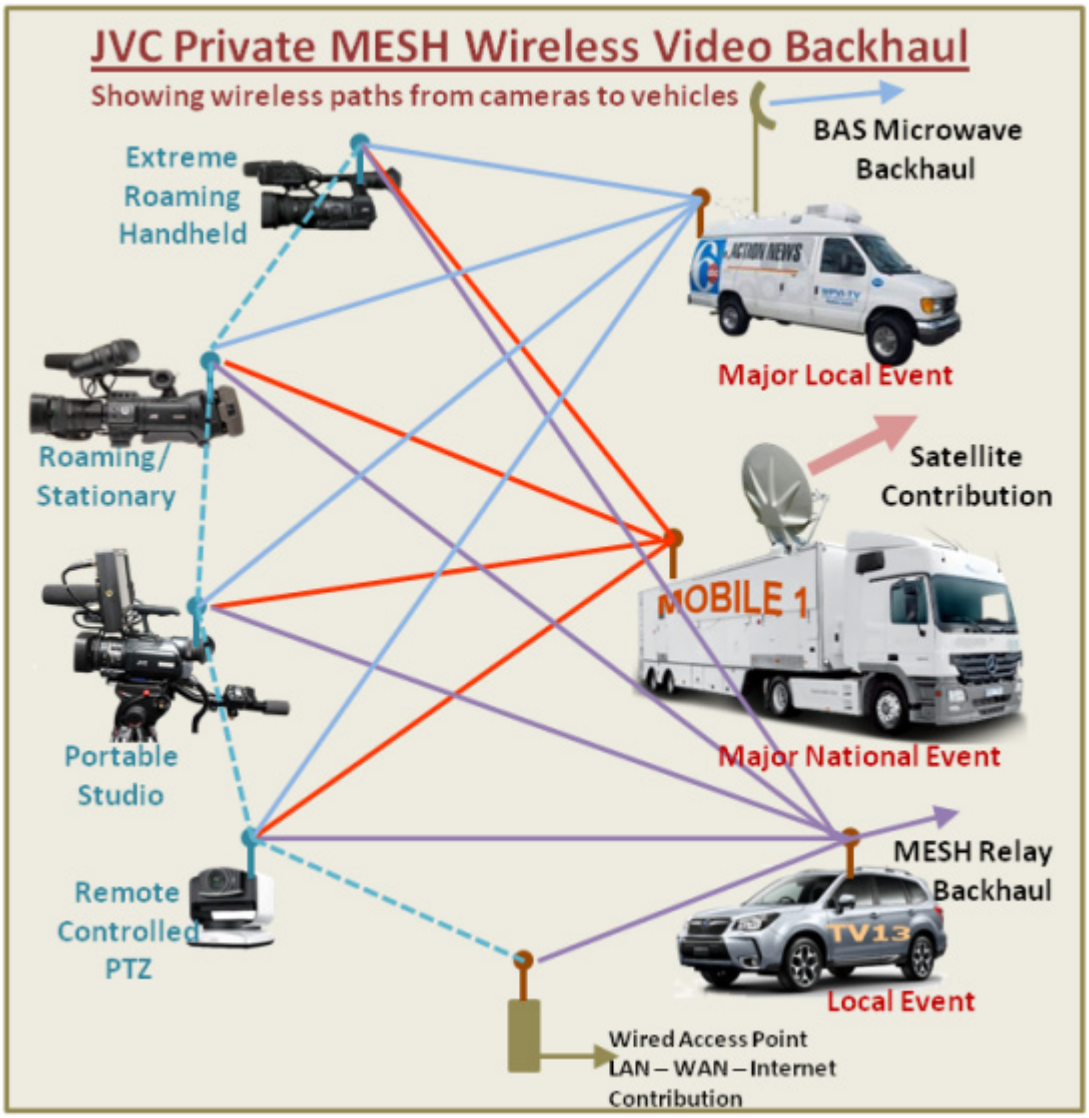
However, JVC's 4G and WiFi wireless LIVE backhaul is a great technology and provides generally very good HD-ENG LIVE backhaul service where coverage exists, and coverage is good in most metro areas except for perhaps some outlying areas. Remember, this is a very cost effective way to get HD-ENG LIVE remote backhaul. No need to use a HD-ENG Van unless the LIVE news location is in one of those outlying metro areas without 4G-LTE coverage. So, although your JVC ProHD IP streaming cameras are covering most of the metro area, you still need to retain a couple of your ENG Vans. But retiring 8 ENG Vans out of 10 is not bad, as it saves you significantly on operational ENG expenses.

BUT, using wireless connectivity in a major televised LIVE event (i.e. Golf tournament) requires of course the ultimate level of reliability and mobility, where the broadcaster must be in full management control of the wireless network and thus the local backhaul connectivity.

You need a Private Wireless Network. Why?

Only a Private Network may be fully managed and controlled by the user/owner, only carrying and prioritizing the IP video traffic necessary for the mission at hand. The **JVC Private MESH Wireless Network** does just that. It's your own private WLAN (Wireless Local Area Network) existing as an isolated island or, at your command, with AP (Access Point) to a larger private network or to the Internet.

The illustration on the next page shows the basic concept that any JVC ProHD camera/ camcorder fitted with the JVC/Silvus microwave transceiver radio (Camera Node) may transmit LIVE video to any other Node within the wireless MESH Network, but specifically to Destination Nodes located in a Production Truck, ENG Van or other vehicle, or to temporary fixed Relay Nodes installed let's say on a tower, telephone pole or a building.



Look at the above illustration. It shows the flexibility of JVC's MESH solution, enabling the range of ProHD Camera/Camcorders to send LIVE broadcast quality HD video over wireless microwave connections either directly or indirectly via one or more additional Nodes. The installation of a Destination Node (or a Relay Node) on a vehicle, tower or building is fast and simple. As the MESH Network is a portable, temporarily installed system, any Node placed on a tower or building would require a battery pack which would last for several days at the most (i.e. Golf Tournament) if no power outlet was available. Such power packs are of course available.

MANET – Mobile Ad-Hoc Network

The term MANET stands for Mobile Ad-Hoc Network). The JVC Private MESH Wireless Network is indeed a MANET, as it is portable, temporary, mobile and wireless.

MANET refers to a multi-hop IP packet-based wireless network comprising a set of Mobile Nodes (installed on video cameras or carried in vehicles or carried by a person) able to communicate while moving at the same time, without any kind of permanently installed Node or wired infrastructure. It is an independent and isolated network with limited (or no) access to the outside world (like the wired or WiFi-linked Internet or a wired LAN or WAN). A MANET may be deployed temporary for hours or days, or have a more permanent deployment lasting for weeks or months.

Ad-Hoc is Latin "for this purpose". Ad-Hoc is often implied or understood to be a temporary situation or condition, as in a legislature formed Ad-Hoc committee, formed for a specific purpose and dissolved when the work is done.

A good example of a temporary MANET application is to support public safety and law enforcement in covering a disaster in a remote area where no communication infrastructure is available. EMS, Police and Fire vehicles, including Command Vehicle, on the disaster scene are given "Mobile Nodes" (mostly 2-way radio telephones but also including video transmission nodes). Another good example of a short term implementation is the one day coverage of a NFL game. A Golf Tournament is a four-day activity, with additional days required for set-up and tear-down.

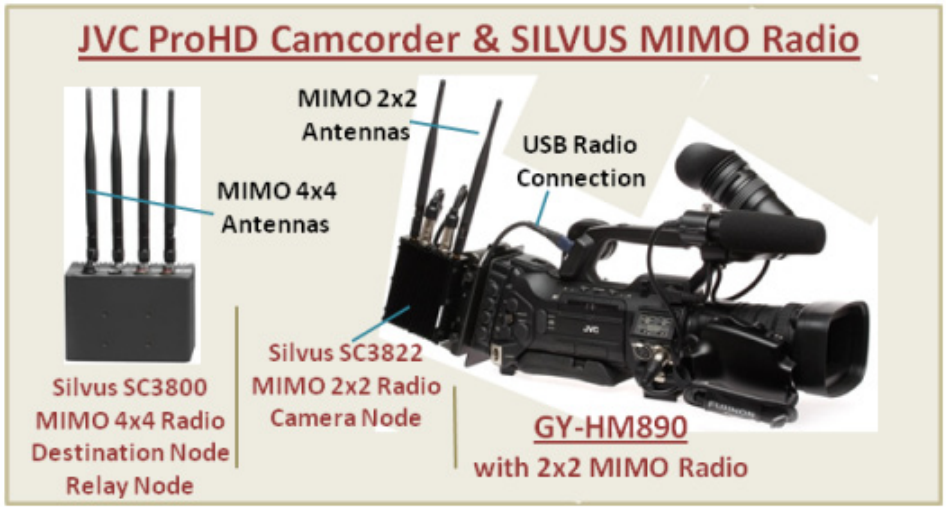
A good example of a longer term MANET application is to support a remote military base to provide a WLAN (Wireless LAN) which also includes reliable connectivity between military vehicles, tanks and helicopters. Long term here means perhaps months even years.

The key benefits of MANET is quick deployment to full operational status, with the ability to re-structure the wireless coverage to meet changing coverage requirements.

The Ideal Combination:
The ProHD Camera with MN-MIMO Radio

JVC Professional Video and Silvus Technologies have partnered to combine JVC's market leading HD camcorders and its embedded HD streaming capabilities with Silvus' proprietary and high performance MN-MIMO solutions and MESH technology, to offer the television industry a much improved and more efficient way to provide multiple HD camera wireless roaming facilities at shorter term remote LIVE events, including covering golf tournaments and sports arenas.

The Silvus MN-MIMO (Mobile Networked MIMO) transceiver technology primarily consists of very advanced proprietary waveform software resident in their generally smaller hardware enclosures known as "StreamCaster Radios", to control and optimize wireless connectivity of LIVE video-over-IP between the radios, at exceptional LOS (Line of Sight) and NLOS (Non Line of Sight) performance and reliability. The radios can in many instances establish and maintain LIVE video connectivity virtually around corners (and in tunnels and caves), through RF reflections, by clever software manipulation of received multi-path reflected signals through MIMO antenna technology. The primary Silvus hardware (with embedded software) products of initial interest to JVC are two (2) specific "radio boxes": the SC3822 MIMO 2x2 "Camera Node" and the SC3800 MIMO 4x4 "Destination Node/Relay Node". SC for StreamCaster. See illustration below.



The difference here is the JVC Private MESH Network where each of several or many radio equipped HD camera/camcorders becomes part of an interactive LIVE video wireless network, as opposed to all other camera-back and bonding-backpack microwave radio solutions where each roaming camera is an independent "piece in the puzzle" trying to connect to the production truck. In the JVC Private MESH Network, every camera radio is prepared to relay another camera's signal in the event a direct path is not available or becomes blocked.

Tailor-made USB Interface

Nearly all of the current ProHD Camcorders include JVC's exclusive AST (Advanced Streaming Technology) embedded Video-over-IP stream processing over the camera's USB host port, to work with Verizon or AT&T 4G-LTE USB Modems, a WiFi USB modem, or to connect up to a wired LAN via a USB-to-LAN adapter. The Silvus radios feature a USB port, thus there is a tailor-made interface where the camera sees the Silvus radio as a USB-to-LAN adapter, making for perfect connectivity, where the radio receives already compressed (H.264) LIVE HD video in the form of formatted IP packets over the USB connection, ready for Silvus real-time processing and RF modulation and over-the-air MIMO transmission.

AST is now F.A.S.T.
Fluent Adaptive Streaming Technology

JVC's recent release of the new 4KCAM camcorders also introduced the improved AST, which is now F.A.S.T. and announcing that the maximum streaming bitrate (subject to available network bandwidth) is now 12 Mbps for the standard HD formats, encoded H.264 which yields broadcast quality HD. A comparison is in order, as most TV stations are now encoding ATSC OTA HD at less than 10 Mbps (in MPEG2, and still delivering OTA broadcast quality to the home audience). It is interesting to note that JVC's feedback from TV stations' experience with ProHD streaming camcorders in LIVE HD-ENG use over 4G-LTE backhaul generally agree that 3 Mbps HD LIVE streaming is quite acceptable for remote/on location LIVE news reporting.

The Silvus gross bitrate over their MESH Network radios may reach upwards of 80+ Mbps, however, the net payload in terms of HD video streams is significantly less, but multi-hop and multi-routing may carry several 10 Mbps video streams reliably to destination. In the event of a relatively large number of HD cameras in a smaller network, the bitrate from each camera may be reduced to avoid bottlenecks and/or provide more than one Destination Node, or groups (clusters) of radios may operate on separate frequencies (assign to each group) doubling or even tripling the overall network capacity for LIVE cameras.

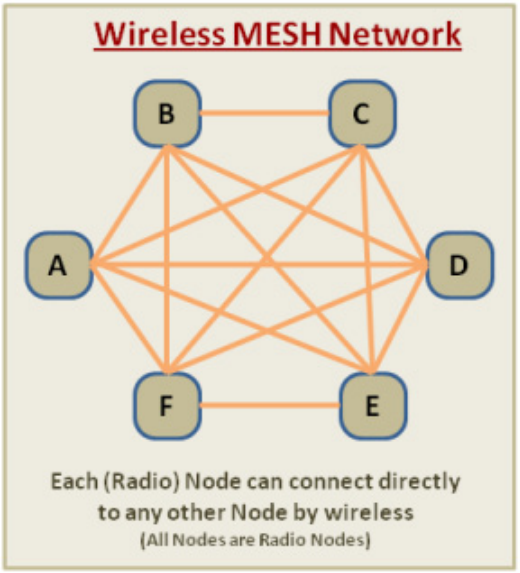
The good news is that JVC provides **FREE** AST/F.A.S.T. software upgrade in the field for the camcorders originally purchased with the AST streaming. The upgrade is accomplished by accessing the JVC support website. The following ProHD camcorders are subject to FREE in-the-field upgrade to F.A.S.T. (to be entirely performed by the customer, no hardware needed, subject to terms, US and Canada): GY-HM890 – GY-HM850 – GY-HM650

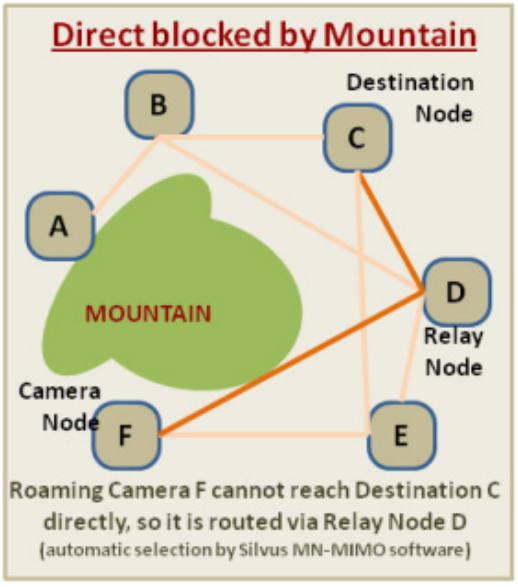
The F.A.S.T. streaming in the just released 4KCAM camcorders are limited to the GY-LS300 and the GY-HM200 models, and currently to HD/SD/Proxy formats. Because of the rather small

(handheld) form factor of the 4KCAM cameras, the Silvus radio must be belt-mounted together with a separate radio battery pack (not yet available).

What is a (Wireless) MESH Network

A **MESH Network**, nearly always wireless, is a network topology in which each **Node (each a Silvus Transceiver Radio)** may relay data for the network. In the JVC PrivateMESH Network, such **MESH Nodes** all collaborate as needed to route and transport LIVE video packets in real time through the MESH Network with the overriding primary objective of delivering timely and reliable LIVE video to the Destination Node let's say located at the TV Mobile Production Truck. By using radio waves and software driven intelligent radio transceivers (as Relay Nodes and Camera Nodes) positioned within the coverage area, the TV Production Truck may receive LIVE video from all roaming cameras concurrently from any location within the coverage area.





Every MESH Node is a radio transceiver, capable of transmitting, receiving, buffering, and forwarding data in UDP/TCP protocols over the IP-based private radio communications channel. The quantity of Nodes required to cover an event is of course subject to the size of the area, the local topography (is the area mountainous, hilly or relatively flat, or urban) and the extent of desired coverage. Buildings may impede connectivity, but also provide benefits in the form of RF reflections.

Looking at the illustration to the left, Node-C is the Destination Node (perhaps at the TV Production Truck). Node-F is one of several roaming cameras, all requiring to reach Node-C with LIVE HD video. Camera Node-F Line of Sight to Node-C is blocked by the mountain, thus Silvus' MN-MIMO radio-resident network software (resident in all radios) makes an automatic and seamless (re)routing via Relay Node-D.

Note that a MESH network does NOT have a central point of network management, but all the Nodes interact and communicate with each other through the resident-in-each-node MN-MIMO/MESH software and making automatic network operational and routing decisions as conditions require.

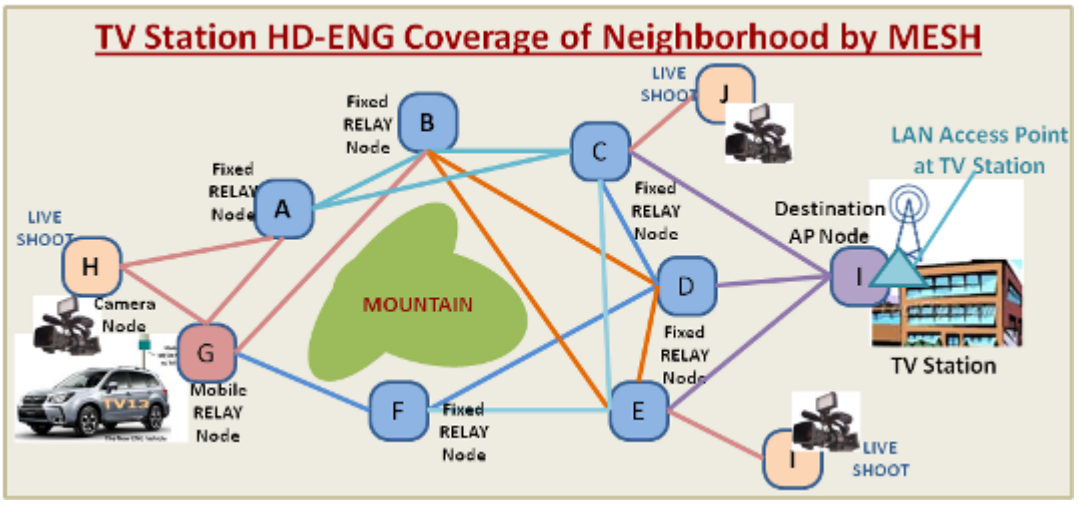
Automatic Self-Forming & Self-Healing = Exceptional Reliability

Recall that, in a wireless MESH Network, all MESH Nodes are connected to each other, either directly (one hop connection) or through other Nodes. The Nodes' firmware include algorithms as to Self-Form and Self-Heal in order to form the best routing to get the LIVE video from Camera-Nodes to the TV Production Truck or, even in HD-ENG applications, to the TV Station, and, if a certain active routing breaks down for whatever reason (equipment breakdown, power outage, additional allowed IP network traffic, temporary RF path blockage etc.), the Nodes' resident software will automatically and dynamically Self-Heal by re-configuring and re-routing the LIVE HD video without interruption.

Key Neighborhoods HD-ENG Applications

To provide MESH wireless network coverage throughout a metropolitan area (DMA) is a difficult proposition, both financially and operationally, as it would require a large number of fixed installed Relay Nodes. However, to cover specific neighborhoods where HD-ENG microwave trucks are dispatched frequently may make sense. In the Los Angeles area for example, "square-mile+" MESH coverage may be accomplished cost effectively by installing several fixed location Radio Nodes, with at least one of the fixed Nodes connected by fiber to the TV Station or by wire to the Internet to reach the TV Station. There always seems to be TV news coverage from Hollywood, LAX and the Santa Monica pier. And there are close-by hotels where the Destination Node may be located and wired to the Internet. What's the benefit? No more sending out an ENG Microwave Van to Hollywood or to LAX or to Santa Monica. Just dispatch a video journalist in that new smaller SUV with a JVC ProHD camcorder fitted with the Camera Node. And he/she is ready to backhaul LIVE HD as soon as the camcorder is turned on.

So JVC's Private MESH Private Network can also provide unprecedented reliability in delivering LIVE ENG video without interruption to the TV Newsroom, from selected neighborhoods within the DMA with each "square-mile+" area served perhaps by 2 to 4 Fixed Relay Nodes of which one is also the Destination Node.



The illustration above shows a possible application of JVC Private MESH Wireless Network serving a larger neighborhood relatively close to TV Station location, making it possible to locate the Destination Node (also Access Point to TV Station's LAN) at the TV Station. Again, wireless MESH Network management is automatic and dynamic (but not central) unless there is a specific need for human intervention. The path from **Camera Node H** to **Destination AP Node** at TV Station may take one of two major paths, north or south of the mountain, determined by the "MESH Node Coalition" for the purpose of deliver the LIVE HD reliably to the TV Station, including delivering two or more LIVE HD stream concurrently on occasions.

Self-Forming and Self-Healing features are only available in true MESH Networks where there are at least two (2) possible paths. For example, it is obvious that Self-Healing cannot occur in a simple serialized 5-Node 4-hop "string" network. If one Node fails, there is no other Node available to take its place by re-routing.

Helicopters and Drones may be outfitted with JVC camera/camcorders, Camera Node or Mobile RELAY Node.

The JVC Private MESH Wireless Network deploys the following types of "specialty Nodes" in order to optimize the Network's performance, either based on Silvus StreamCaster SC3822 for the Camera Nodes or StreamCaster SC3800 for Relay and Destination Nodes. The resident MESH/MIMO software in each type may be optimized/configured for specific Node duty:

The Camera Node (generally a SC3822 Radio) – as a camera-back/side attachment, accepts a LIVE H.264 compressed IP encapsulated HD feed over the Camera's USB host connection, seeing the Node (Radio) as a standard LAN connection. The MESH Network is indeed a LAN but a wireless one (WLAN). The Camera Node also provides for return audio and IFB connectivity. The Camera Node modulates the IP packetized HD video in COFDM in its RF transmitter section.

The Mobile RELAY Node (generally a SC3800 Radio) is primarily a RF transceiver with (as the name implies) the sole functionality to receive the LIVE video data train radio signal from any other MESH Node, but particularly from a Camera Node, and to relay that data train to the next Node as directed by the embedded Self-Form/Self-Heal firmware algorithms. The Mobile RELAY Node is configured to receive and transmit while moving, and to dynamically and seamlessly switch connectivity between other Nodes, i.e. when driving leaving one Node's primary wireless coverage area and entering another Node's primary area. As the Mobile RELAY Node is generally carried by a "SUV ENG vehicle", the Node needs the capability to connect with video editing laptops etc., via wired Ethernet or via WiFi Direct, as the laptop may be the source for backhauling files (FTP) edited on location by the "lone ranger" video journalist.

The Fixed RELAY Node (generally a SC3800 Radio) – is installed in a fixed location often as an Edge Node where an "inner circle" of many Edge Nodes make up the immediate wireless service area, where LIVE backhaul connectivity is guaranteed, by roaming cameras (Camera Nodes) connecting directly to the Fixed RELAY (Edge) Nodes. These Edge Nodes may wirelessly connect directly with the Destination ACCESS POINT Node (or Nodes) at the TV Production Truck or near the TV Station, or via other Nodes located inside this immediate wireless service area. Any Fixed Node may of course connect permanently directly to the Internet (watch out, not private!) or wired through fiber back to the TV Station if desirable.

The Destination ACCESS POINT Node (generally a SC3800 Radio) – is the "wireless destination" back at the TV Production Truck, or the ENG Van, or the new ENG SUV, or at the TV Station, for LIVE and for FTP, whether backhauling one, two or several LIVE video streams. The Destination ACCESS POINT Node is largely in the RX mode excepting brief return transmissions of acknowledgement and MESH management data to the Network Nodes. Destination ACCESS POINT Node may include software intelligence to reorder and assemble IP packets into a fully functional LIVE HD stream delivered to the TV Production Truck for satellite backhaul to NOC or connecting to TV Station's wired LAN.

MIMO – The Essential Part of MESH Radios

We have seen how Wireless MESH Networking can substantially improve the reliability and the availability of LIVE HD backhaul, while eliminating or reducing the need for the cost of temporarily install extensive cabling. In addition, we have presented ways for TV Stations to install Private MESH Wireless Networking in local DMA neighborhoods where it may make sense (i.e Hollywood, LAX, Santa Monica Pier considering the Los Angeles DMA), thereby making it possible to reduce the number of ENG Vans and reduce ENG operational expenses. But we are not done explaining yet! JVC's new Private MESH Wireless Network includes MIMO, being absolutely essential to the overall advantages of this new MESH network architecture.

MIMO = Multiple Inputs Multiple Outputs

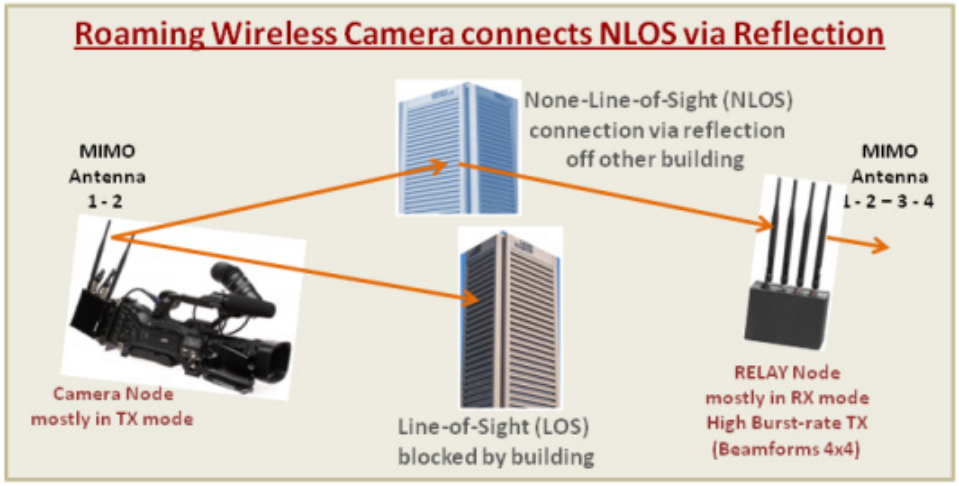
Referring to Antennas and how the Radio dynamically splits TX power and RX data-rate between the available antennas, and adjusts the directional TX and RX lobes.

Silvus MN-MIMO radio technology enables a sophisticated yet practical technique for transmitting and receiving multiple data-signals through multipath propagation on the same radio channel at the same time, thereby increasing the data-rate and link range achieved over a given link as compared with the traditional RF link (before MIMO and before MN-MIMO technology was available). Multiple Inputs and Multiple Outputs refer to the number of active antennas electrically attached to the transmitter and to the receiver circuits.

MIMO technology by itself is not proprietary, as MIMO has been (and is being) used by the wireless telecom industry for a number of years already, in 4G-LTE broadband cellular, WiFi and WiMax. You may even have MIMO in your home as part of any newer WiFi router. To a large degree, MIMO is the reason for the ever expanding wireless data-rate being achieved by any type of broadband wireless. **Silvus takes MIMO to the next step of mobile wireless broadband performance and reliability, in their proprietary Mobile Networked MIMO (MN-MIMO).**

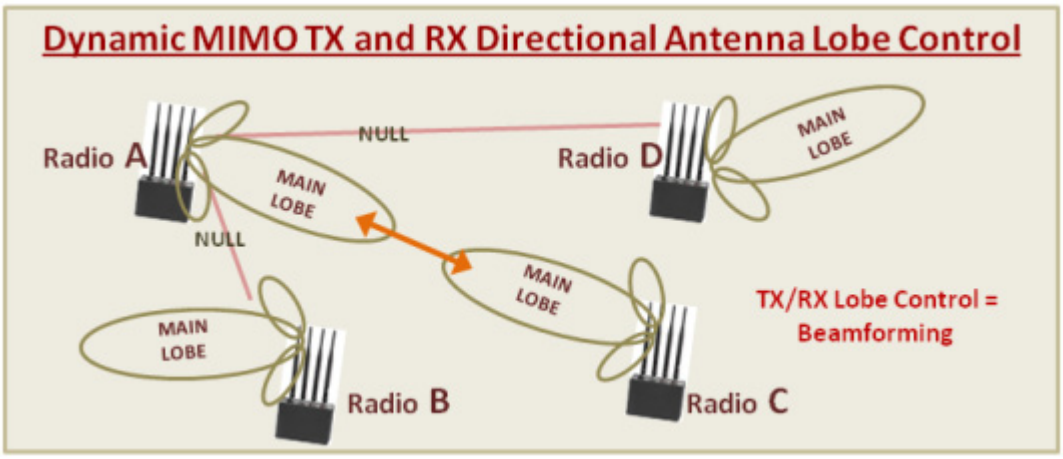
Silvus Technologies has devoted more than 10 years of research in the development of MN-MIMO and the underlying hardware products, supported by the U.S. military with $40 million in funding over the years, resulting in a superior wireless waveform ideal for high bandwidth video in multi-path difficult environments in fully mobile MESH applications. No other waveform and modulation scheme combination can match the performance of MN-MIMO in mobile-to-mobile connectivity.

Remember: This is a type of single frequency network. The MESH Radio Nodes all operate on the same single frequency (with a certain channel bandwidth), so there is ample opportunity for serious interference between the Nodes. At any one time, several radios are transmitting with other radios receiving, concurrently backhauling more than one LIVE HD video signal. The Network makes sure that any Radio in the receive mode ONLY receives and processes the right transmitter signal at that specific time.



In the above illustration, the Camera Node shares the TX RF power between its two (2) antennas, while the Relay Node's four (4) antennas each have the opportunity to receive multiple radio waves from each of the TX antennas, via multi-path reflections. The direct (LOS) path is blocked by the building, but sufficient signal strength is available via the RF reflection off the other building. This is named a 2x4 MIMO link configuration. Depending on the local topography and the required/desired local backhaul distances in the larger coverage area, the MESH wireless network installation may deploy MESH Node Radios of mixed MIMO.

The MESH Nodes each include embedded firmware which automatically and dynamically controls the directional lobe properties of the multiple antennas when necessary, taking maximum advantage of the ability to selectively receive direct and/or reflected radio waves thereby optimizing the performance of each wireless hop, and prevent co-channel interference.



The above illustration shows **Beamforming**, the ability of each MN-MIMO-equipped MESH Radio Node to dynamically alter the receive antenna lobes from omni-directional to highly directional (in any direction as needed), pointing the main lobe towards the radio (or reflection source) which at that time is transmitting targeting that specific radio, thereby substantially increase the effective signal sensitivity of that link. Later this year, Silvus expects to introduce TX beamforming to add to their existing RX beamforming. TX beamforming will increase effective radiated RF power in the main lobe direction when transmitting, also increasing the received signal strength in the target radio, and further improve net payload capacity over the MESH network.

This is the "old fashion" directional antenna gain. Highly directional antennas also produce much smaller side-lobes where NULL points exist in the transition from Main Lobe to Side Lobe. As the maximum RF field strength enabled by the Main Lobe gain is taken advantage of, so may the NULL azimuth be helpful in eliminating co-channel interference in neighboring MESH Nodes. Look again at the above illustration. In the instance shown, Node A is transmitting to Node C in the receive mode, with each utilizing a highly directional lobe. Node B is receiving from another Node, on the same frequency used by Node A to transmit to Node C. (Remember again, this is a Single Frequency MESH Network, to a large degree made to work by the MN-MIMO technology including Beamforming.) But Node A's NULL point is in the approximate direction of Node B, making sure that Node A's transmission to Node C does not interfere with Node B's reception from another Node. **In the next instant**, the antenna lobes may switch to different configurations, as Node A is may be receiving, Node C is transmitting, from/to different directions.

The MIMO technology adds and exploits the 3rd dimension of SPACE to the traditional radio communication of Time and Frequency.

Spatial Multiplexing (SM) splits the high data-rate stream into several lesser data-rate streams where each such stream is transmitted from a separate antenna. I.e. a Node with four (4) antennas may then transmit four streams simultaneously to the receiving Node and, subject to the receiving Node also having four (4) antennas, may maintain separation and treat the streams as separate channels for relay purposes, and possibly route each stream differently, later to be combined at destination into let's say a LIVE HD stream.

The MIMO benefits:

(As compared to SISO - single TX/single RX antennas - omni-directional)

- Higher data throughput – Future compressed 4K-UHD assured
- Improved range - Longer distances between Nodes – Less Nodes to cover "the Golf Course"
- Increased robustness – Improved reliability
- Reduced output TX RF power for a given Hop distance

Illustration shows the extreme coverage and capabilities of MN-MIMO for First Responders in an Urban setting. Similar coverage is readily available for broadcasters in LIVE reporting with multiple wireless roaming HD cameras using JVC Private MESH Video Network covering major news events and disasters.

JVC's New Disruptive Private Wireless MESH Video Network:

The Next BIG Thing for TV Broadcasters & Remote LIVE Event Productions

The JVC Private MESH Network Solution moves Mobile/Remote Event Acquisition and "first mile" LIVE contribution in a quantum leap, to offer new levels of LIVE backhaul performance and reliability, HD now, while adding 4K-UHD capability later this year. The Private MESH Network is based upon the following architecture and technologies:

- MESH Networking Architecture
- MIMO Multiple Diversity Antenna Technology
- Beam-forming RX Technology
- MANET Mobile Ad-Hoc Networking Architecture

SiLVUS TECHNOLOGIES

SC3800

SC3822

Private MESH Wireless Network Features

- Ultra-low Latency <10 mS per hop (excludes HD encoding)
- Radios support 400 MHz to 2.7 GHz or 4 to 6 GHz
  (include BAS 2/2.5 GHz and 2.4/5 GHz WiFi)
  (custom frequencies available)
- Selectable RF bandwidth modes 5 MHz, 10 MHz or 20 MHz
- Max 1 W Transmit Power (roaming/fixed Radios)
- Max 1 W Transmit Power (Central Transceiver – For each of 4 sectors)
- Add-on RF Power Amplifiers available – to FCC limits
- Ethernet (UDP/TCP), USB and RS232 interfaces
- Encryption DES (Data Encryption Standard) – AES optional
- GPS and Multicast Support
- Connectivity under highly mobile conditions
- Connectivity in NLOS multipath rich environments
- Add-on expansion module to provide Bluetooth, WiFi
- Add-on expansion module for voice, IFB etc.

JVC ProHD Camcorder
GY-HM890 w/ SC3822

Exceptional Benefits

- To substantially increase reliability, range and quantity of roaming wireless HD cameras at large Televised LIVE Remote Events, and deliver higher quality HD (and soon 4K-UHD)
- To substantially reduce cost of temporary cabling and of labor required setting up and tearing down at the Venue, to save overall time and labor
- To provide a private wireless network, under full control by the user/broadcaster
- To enable the use of highly cost effective, broadcast quality ProHD Cameras

About JVC Professional Video

Headquartered in Wayne, New Jersey, **JVC Professional Video** is a division of JVCKENWOOD USA Corporation. The company is a leading manufacturer and distributor of broadcast and professional video and audio equipment, D-ILA front projection systems, and Super LoLux HD video security products.

As an early pioneer in the capture, display and recording of moving images, JVC has a rich legacy of technological innovation. In the analog world, JVC developed the color recording technology that made VCR's possible, exemplified by the company's invention of the VHS format. JVC's work in digital compression algorithms is now part of the MPEG standard used in virtually all digital formats including Blu-Ray, and digital broadcasting.

For further product information, visit JVC's Web site at http://pro.jvc.com email proinfo@jvc.com or call toll free (800) 582-5825.

JVC Professional Video

A Division of JVCKENWOOD USA Corporation

Headquarters & East Coast Sales & Service

1700 Valley Road, Wayne, NJ 07470

Phone: (973) 317-5000 Fax: (973) 317-5030

Email: proinfo@jvc.com

West Coast Sales & Service

2201 E. Dominguez Street

Long Beach, CA 90810

Phone: (562) 295-1100 Fax: (562) 295-1156

4K CAM

Super-35

4:2:2 60p 50Mbps

ProHD

On Air. On Time. On Budget.

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