DOMO
BROADCAST SYSTEMS

WHITE PAPER

IP Mesh in Broadcast Applications

For a number of years after IP Mesh technology first became available, the prevailing consensus was that it was an interesting technology but did not really have a role to play in outside broadcast. That is definitely no longer the case.

IP control and monitoring of equipment is now almost universal. With the continued growth of remote production/REMI, not to mention video streaming and VoIP comms, there are now multiple uses for a private, robust, long-range wireless IP network.

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For the moments that matter

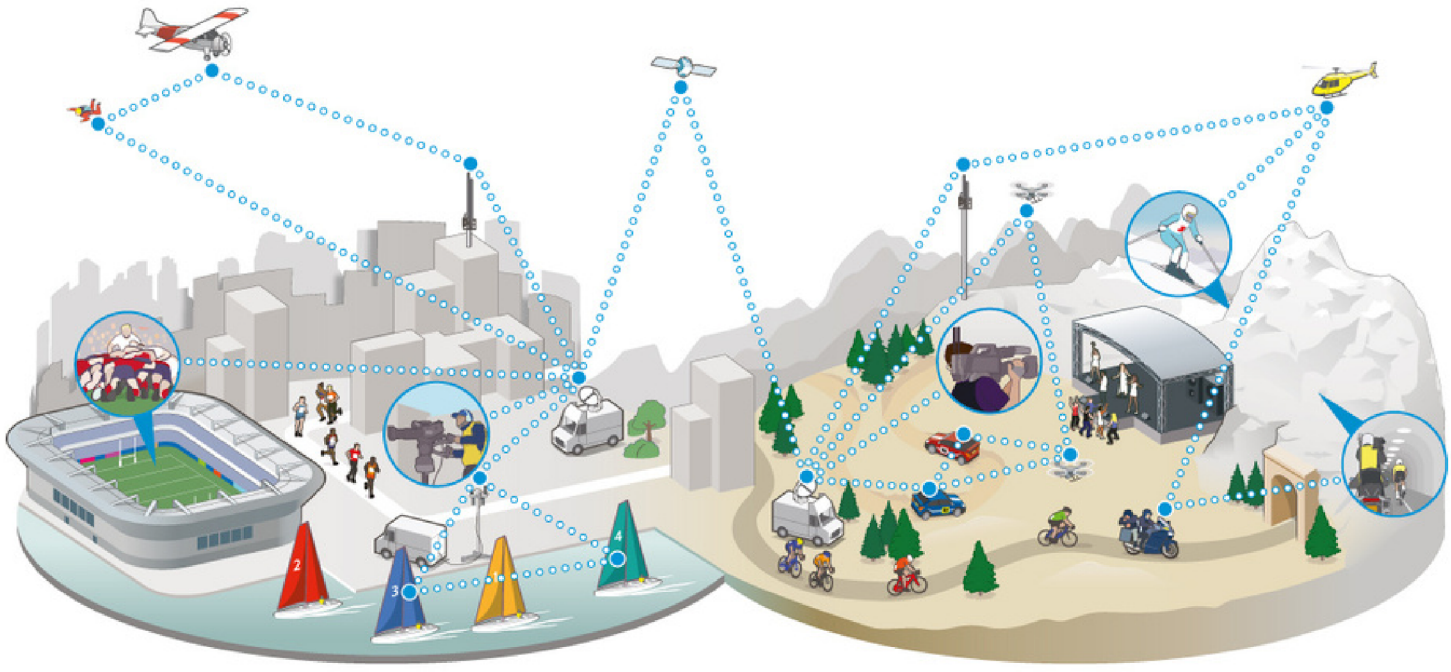
Domo's IP Mesh Technology

Domo's IP Mesh is a single-frequency, multi-node, IP network. It uses COFDM RF modulation with the addition of Time Division Multiplexing, so every node (or radio) in the network has an allocated time slot to contribute data. The complexity of the modulation, transmission timing and data routing is beyond the scope of this paper. However, the controlling algorithm has been developed over many years, and the range, robustness and data-rate performance of Domo's IP Mesh is such that we are confident in any head-to-head test.

IP Mesh can combine multiple required functions on a single platform, simplifying workflow, reducing rigging and ultimately lowering costs. It can provide live GPS data and mobile communications, giving directors and event control management invaluable data. In some situations, it can be used to transport video, although we do not advocate it as a direct replacement for a COFDM wireless camera system, in most cases.

In Domo's IP mesh. there is no central or master node; the units mesh with each other. The control algorithm is integral to every unit, meaning there is no single point of failure and no base station to set up. This also means every node contributes to the robustness and range of the network, which is in contrast with private 5G and other communications systems.

The portfolio is broad, and includes everything from ultra-small 60g 2x100mW radios up to 2x15W units for long-range requirements. Some nodes include HD H.264 video encoding, and different form factors are available to suit various applications, from OEM offerings to IP68 rugged enclosures.



Applications

Voice Communications

Domo Mesh has audio codecs and sophisticated audio handling as standard.

Each radio can contribute to one of 32 different talk groups and listen to multiple talk groups at the same time.

In addition, two 'Push To Talk' keys are available for different combinations, enabling complex audio networks without the need for external VoIP audio routing, although a Mesh network can provide the IP layer for third-party VoIP systems.

IP Networking

IP networking is the core of what you'll gain from IP Mesh. Some settings prevent the network from being flooded with data, but essentially it is a transparent network. Because multiple data types can be encapsulated into IP packets, applications include:

- control of remote asset (for example, PTZ cameras, or videos switchers)
- GPS
- IP camera control
- video streaming
- autocue data
- private internet connections
- DMX lighting control
- GPIO
- athletes' biometrics
- vehicle telemetry.

Case Studies

International Yacht Racing

Two major series employ Domo IP Mesh for similar systems.

On the race boats, operators at the OB, control gimbal cameras and a video switcher, which is used for selecting the 4K camera to transmit (via COFDM) to shore.

Communications are enabled for race officials and sailors, in addition to the production team, whose director can talk to the chase boats and helicopters.

The final service on the IP Mesh network is GPS data from the race boats, used for graphic overlay and race control.

Case Studies

Oxford Cambridge Boat Race

Presteigne Broadcast Hire were early adopters of IP Mesh and have used it on the Oxford Cambridge Boat Race for 10 years. To cover the 4.5mile course, 10 fixed nodes are positioned on the shore and six mobile nodes on the chase flotilla.

The resulting network has multiple uses:

- video is streamed from the umpires' boats to the OB, for use by race officials
- the OB has PTZ control of cameras on the race boats
- camera control/racking of broadcast cameras on the chase boats
- production audio lets the director talk to the camera operators
- a backup exists for wireless microphones.

Skyrunning – Zegama Spain

This extreme mountain sport, which sees competitors running/climbing at altitude, would be impossible to rig with cabled cameras. COFDM would also be technically challenging as repeaters with multiple frequencies would be needed.

However, Mesh nodes are stationary, and as such can be set up with directional antennas for high bandwidth links.

In this system, the primary video is transmitted over the Mesh, and the nodes act as repeaters to give full coverage of the course.

Four camera feeds at 6MB/s are sent, plus a multi-viewer and program return feed at 2MB/s each. This event also employs Unity talkback using the Mesh as the transport network.

Without Domo Mesh, coverage of this event would not be financially practical.

Case Studies

Cycle racing – Colombia

At the end of 2023, we demonstrated to RCN Television in Columbia a versatile solution that could be replicated for many different events. In this case, camera feeds from three motorcycles are repeated via a light aircraft using COFDM to an OB truck, which also receives a video feed directly from a helicopter. All are then sent via satellite to the MCR. Mesh is used to provide communications between everyone: all three bikes, the engineers on the plane and helicopter are all in a Mesh, together with the OB truck.

Starlink is used to enable a Mesh link for the MCR, so the director can talk to the whole crew. In addition, GPS locations for all nodes are available to the MCR, OB and crucially the pilots to give information previously unavailable, which is helpful in managing coverage.

Coach Communications

This solution is supported as an OEM offering to a third party, who integrates IP Mesh into a specifically designed belt pack for sports coaching.

Although the native audio capability of the Mesh system is sufficient for their needs, the customer designed a bespoke user interface and form factor for ease of use.

The rugged RF performance and security of the network were pivotal in the client's choice of technology

Case Studies

Drone/Buggy and Camera Control

In April 2024 at NAB, we will be demonstrating Mesh's true versatility. The Mesh will provide the platform for control of three separate systems: a Motion Impossible Agito Dolly, a Gimbal camera and Cyanview camera control/paint.

In addition to this, the Mesh will facilitate the use of a POV camera to aid driving the dolly, whilst a COFDM link will provide the feed from the camera.

On-set Comms and DMX Lighting Control

As film and episodic productions become ever-more sophisticated, WiFi and licence-free bands are degraded due to overuse. Lighting is critical in large budget productions, which is why we have integrated a DMX control interface that can run alongside a non-centralised comms system, giving flexibility to film units moving to separate locations.

Summary

IP Mesh is most often used for production support, with multiple applications. It is scalable without a central controller and highly mobile. Its role in broadcast is now firmly established.

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