



# MOTOROLA WIRELESS BROADBAND

ADVANCING MOTOROLA MESH WIDE AREA NETWORKS WITH THE POWER OF OPPORTUNISTIC RADIO LINK ADAPTATION



Motorola's Mesh Wide Area Network (MWAN) product portfolio is embracing the power of ORLA, Opportunistic Radio Link Adaptation, which is an improved element of Motorola's patented MeshConnex™ Routing Engine. The MeshConnex Routing Engine provides efficient routing, low hop latency, low routing overhead, high-speed handoffs and proven scalability. MeshConnex uses Motorola's patented Layer 2 routing technology to find and establish throughput-optimized connections.

## ORLA DEFINED

The Opportunistic Radio Link Adaptation (ORLA) algorithm is a key decision-making element within MeshConnex, designed to select data rates that will provide the best throughput. Instead of using local conditions to decide whether a data rate is acceptable or not, ORLA is designed to proactively probe other rates to determine if greater throughput is available.

If these other rates do provide improved throughput, ORLA intelligently adjusts its selection tables to provide higher performance. ORLA provides improvements both on the client side of a mesh network as well as in the backhaul capabilities. ORLA is a key differentiator, which will be further explored in this paper.



## WHY ORLA WAS CREATED

ORLA addresses typical link adaptation algorithms that exist in two popular forms as outlined below:

### Predictive Algorithms

These algorithms assume that a radio channel is deterministic and that a rate can be selected with accuracy by simply knowing some simple characteristics of the channel such as the noise floor and the path loss. Such algorithms overlook the fact that channel characteristics vary considerably and that packet collisions are never taken into account in propagation models.

### Reactive Algorithms

These algorithms determine whether a current rate is acceptable and whether it needs to be increased or decreased. Most commercial implementations follow this principle. This method works for about 80% of cases. However, there are circumstances involving interference and fading where higher data rates cause fewer collisions; therefore, lowering the data rate would make this worse.

Consequently, ORLA was developed to address the issues above and create a hardened link adaptation algorithm for clients and backhaul, mitigating any issues encountered with reactive and predictive style algorithms.

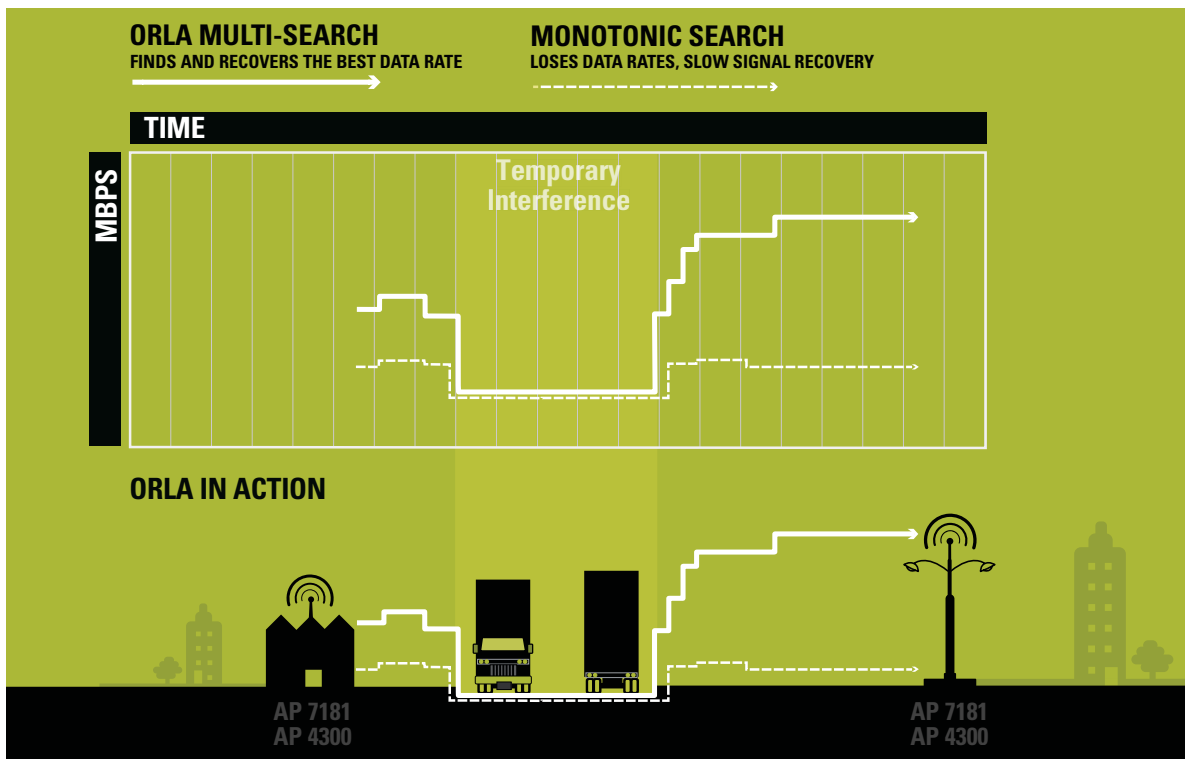
## IMPROVING CUSTOMER SATISFACTION WITH ORLA

A customer will experience many direct benefits by using the new ORLA algorithm with a Motorola MWAN product.

### Throughput

When deploying a mesh network it should be designed to provide the clients with the highest available data rate as well as with a robust and stable TCP/UDP connection within the environment deployed. One of the key advantages of ORLA is the prevention of “cratering”, which affects the data rate and connection. For example, there may be a device or backhaul connection that is able to sustain higher data rates, but an event causes that client/backhaul link to adjust itself to a lower data rate. This event could be an object passing through the Fresnel Zone. ORLA is designed to prevent and overcome such events from affecting the throughput and ensures the higher desired data rate is maintained for the clients and the backhaul connections.

The graphic below illustrates how ORLA constantly searches out the best data rate providing better throughput and a faster recovery versus those using a monotonic search. In a perfect world there would be no collisions in the 802.11 domain and the sustained throughput against RRSI (Received Signal Strength Indication) would be ideal.



## **CUSTOMER EXPERIENCE IN A REAL WORLD SITUATION**

Customers typically using other mesh networks have seen 802.11g cards connect initially at 54 Mbps, but eventually this data rate would decrease to 1 Mbps due to poor rate control algorithms. Normally it would require a re-association to the AP to restore the higher data rates. However, ORLA has resolved this performance gap for both UDP and TCP protocols, maintaining and sustaining the highest possible data rates. The algorithm is also smart enough to know when to stay at a higher rate even though the packet completion rate may be lower. For example, it is better to be at a 50% packet completion rate at 11 Mbps than 100% packet completion rate at 1 Mbps.

## **FASTER MWAN NODE CONVERGENCE AND ROUTING**

Mesh networks should be self-forming and self-healing. As ORLA is part of Motorola's mesh routing algorithm, it is important that there is convergence for both backhaul links and client access. As an example, from a client perspective the connection must enable optimal download speed quickly and not have to wait to throttle to the optimal level, which would represent itself as a period of inactivity. ORLA achieves this rapid convergence for both clients and backhaul connectivity.

In addition to this, ORLA enables links with marginal SNR (signal-to-noise ratio) to provide increased throughput; therefore, the routing metric of these links will improve also. This means in poor RF environments with increased interference, "stickier"

routes can be provided, allowing marginal links to be used as hops within the networks, aiding with tricky design problems. By choosing shorter routes and maintaining sustained and consistent data rates it may also be possible to reduce the average number of hops in a network. The key with ORLA is its ability to consistently and intelligently select the correct route, allowing the client track to reach its destination irrespective of the environmental conditions.

## **IN CONCLUSION**

ORLA has been proven to be a consistent and robust link adaptation algorithm, and is a key component of the Motorola Mesh Wide Area Networks portfolio today. The wireless technology will take advantage of the higher throughput and data speeds of this link adaptation algorithm, which is part of Motorola's patented MeshConnex™ routing engine. This will provide an opportunity to maximize the 802.11n data rate in any given environment, and maintain robust throughput.

With ORLA, the end result for a customer using a Motorola Mesh Wide Area Network is sustained throughput at the highest possible data rate.

## **ABOUT WIRELESS NETWORK SOLUTIONS**

We deliver the seamless connectivity that puts real-time information in customers' hands and the agility needed to grow business or better protect and serve the public. Integrated with world-class devices, our solution portfolio includes indoor WLAN, outdoor wireless mesh, point-to-multipoint, point-to-point networks and voice over WLAN solutions. Combined with powerful software for wireless network design, security, management and troubleshooting, wireless network solutions deliver trusted networking and anywhere access to organizations across the globe.

[www.motorola.com/mesh](http://www.motorola.com/mesh)

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