BridgeWave

BridgeWave AdaptPath™ Solutions

White Paper

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WHY ADAPTPATH?

Deploying a highly reliable data link between two locations requires careful consideration of the technologies available that allow the user to strike a balance between the performance of the link (throughput, distance and system availability) and overall implementation costs. When connections require gigabit Ethernet speeds, the choice narrows to wired fiber and gigabit wireless bridges. Gigabit fiber services offer outstanding capacity, reliability and security over long distances when fiber is physically present at the required locations, and can be leased or constructed at an acceptable cost point. Gigabit wireless bridges offer comparable capacity, reliability and security over multi-mile distance, and can usually be installed at a fraction of the cost and time it would take to provision a comparable fiber circuit. Traditionally, fiber was the only choice for providing highly-available connections over longer distances. BridgeWave's new AdaptPath™ technology offers a new alternative for deploying gigabit services over extended distances, while maintaining fiber-equivalent service availability.

The multi-gigahertz RF spectrum allocation at 60 GHz and 80 GHz enable cost-effective gigabit wireless communications. At these frequencies, rain is the principal factor affecting link performance. Intense rain downpours scatter energy off the desired path, thus attenuating the RF signal. The greater the distance between transmitting and receiving antennas, the greater the degree of RF signal attenuation. The maximum distance for an RF link is determined based on the rainfall statistics for a given locality and the application's service availability requirements. Lower frequency links below 11 GHz are highly rain tolerant, and are therefore well suited for long distance applications; however these solutions are limited in data capacity due to the limited RF channel bandwidths available at those frequencies.

Prior to the introduction of AdaptPath technology, BridgeWave AdaptRate™ gigabit wireless links set the standard for gigabit link availability over multi-mile distances. Now, BridgeWave's AdaptPath technology takes long-range gigabit link availability to the next level.

The AdaptPath solution creates an all-weather, dual-path data connection by pairing a primary path BridgeWave 60GHz or 80GHz GigE wireless bridge with a lower speed, highly rain-tolerant secondary path. The resulting dual technology solution allows gigabit links to be deployed over unprecedented link distances, while maintaining up to 99.999% service availability.

ADAPTPATH OPERATION

Enabled by a Gigabit Ethernet switch embedded within each BridgeWave radio unit, the AdaptPath feature works by switching application data from the primary GigE wireless link to a secondary path, maintaining service connectivity even during periods of severe rain downpour.

The secondary path can be a lower-speed copper or fiber service (when available and affordable), a license-free 5 GHz wireless bridge or a licensed band 6 GHz or 11 GHz link. Each end of the secondary Ethernet path connects directly to the BridgeWave radio unit's built-in 10/100 copper Ethernet port – no external switching/routing connections or configuration is required. Only the BridgeWave radio's GigE fiber port connects directly to the user's external switch or router.

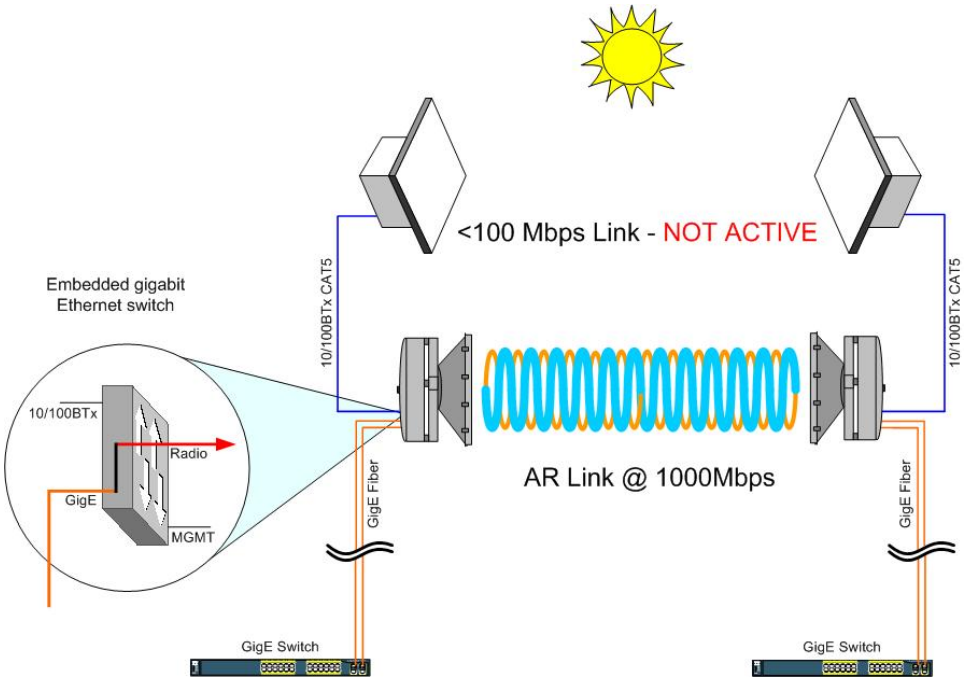

Figure 1 – AdaptRate Normal Operation

In normal operation, user data is sent from the network via the fiber optic cable to the outdoor mounted wireless bridge. Traffic is routed via the internal gigabit Ethernet switch from the 1000Base-SX (GigE fiber) port to the "radio" port, where it is sent over the air to the remote radio unit.

During brief periods of severe weather, rain may cause attenuation of the transmitted signal, yielding errors in the data at the remote end.

In order to provide uninterrupted transmission of data, it is important to proactively switch to a secondary link ***before*** the signal level gets to a point where errors occur.

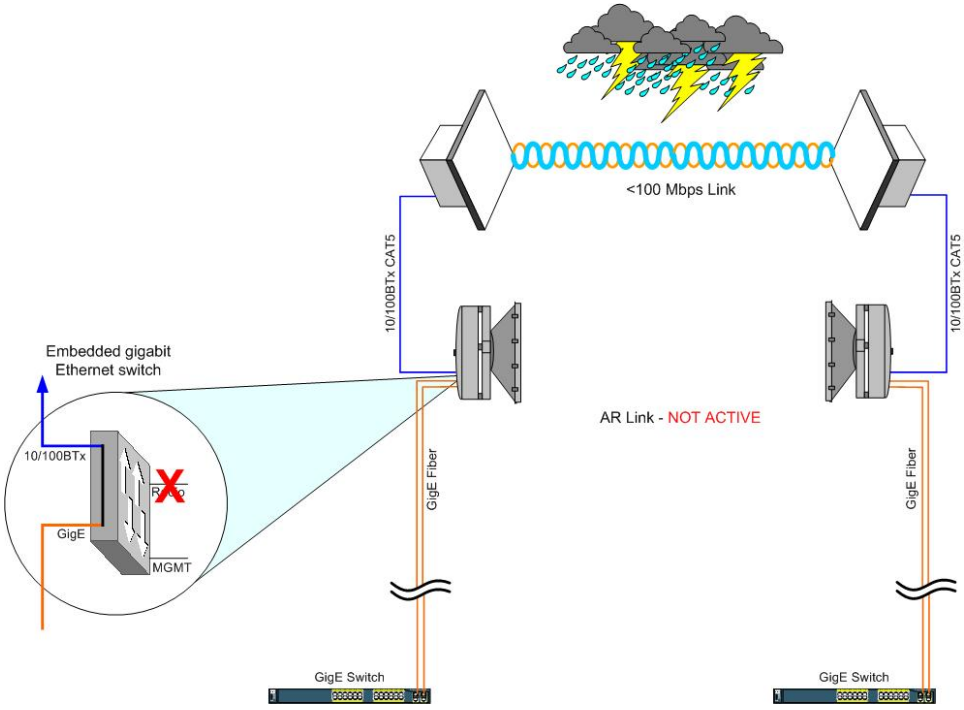

Figure 2 – AdaptPath Operation

The radio unit's management processor continuously monitors the radio's receive signal level. As it senses degradation below a user configurable value, it shuts down the internal GigE switch "radio" port. Traffic is then switched to the 100Base-TX (copper) port where it is sent over the secondary link. The AdaptPath feature handles all the switching functions, and re-routes traffic between paths in less than 50 milliseconds.

The AdaptPath feature also works together with BridgeWave's AdaptRate™ capability. When these features are configured to work in tandem, during a severe rain event the BridgeWave AdaptRate technology initially throttles back the primary path data rate from full GigE to 100 Mbps to maintain error-free link operation; then, when necessary due to increasing rain attenuation, the AdaptPath feature switches traffic over to the secondary path to ensure uninterrupted service. In both the AdaptPath and AdaptRate modes, as the rain fade subsides, traffic is automatically re-routed back to the primary GigE path.

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ADAPTPATH EXAMPLE

Consider the case of an application in the Los Angeles, CA area requiring 99.999% service availability – less than six minutes per year average link outage time. Without using AdaptRate and AdaptPath technologies, this link would be limited to 1.6 miles distance in order to achieve this demanding availability level. Now consider a link using AdaptRate and AdaptPath (e.g. BridgeWave AR80X product) at a 7-mile link distance during an average rainfall year. This link will operate at full GigE speed all but 3.5 hours during the year, or 99.96% of the time. The AdaptRate feature will cause the link to operate for 2.5 of these 3.5 hours at 100 Mbps, for a combined GigE and 100 Mbps operating availability of 99.99%. For the remaining one hour per year (the last 0.01% of the time), the AdaptPath feature will switch traffic to the lower-capacity link. Using a wireline or 5 GHz wireless bridge, it is possible to achieve a combined service availability of over 99.999%.

Mode	Rate	Time in Mode	Cumulative Availability
Primary Link	1000 Mbps	99.96%	99.96%
Primary Link	100 Mbps	0.03%	99.99%
Secondary Link	≤100 Mbps	>0.009%	>99.999%
Link Outage		<0.001%	

Table 1 – Typical availability for a 7-mile AR80X link in Los Angeles

ADAPTPATH PRODUCTS

BridgeWave's GigE wireless links offer a cost-effective means to finesse the traditional laws of millimeter-wave link deployment, providing full GigE data capacity at extended distances without compromising on service availability. BridgeWave is the only manufacturer of GigE links offering the AdaptPath capability. The AdaptPath feature is included standard with all BridgeWave AdaptRate products operating either in the license-free 60GHz band or in the "lightly licensed" 80GHz band. Contact BridgeWave or an authorized BridgeWave reseller for more information.

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