RAD
data communications

Technology Backgrounder

Airmux-200 – Automatic Adaptive Rate

Automatic Adaptive Rate is a method of adapting the transmitted rate and modulation dynamically according to interference conditions, in order to optimize data throughput while maintaining the service quality.

Airmux-200™ Automatic Adaptive Rate

In Airmux-200, Automatic Adaptive Rate is an optional setting that enables each link to adjust its throughput automatically according to interference conditions. When increased interference is detected, which could endanger the quality of the link, the Ethernet throughput is decreased temporarily to ensure that TDM and Ethernet traffic is maintained, and that the link stays up. As the Airmux-200 delivers both TDM and Ethernet traffic, the Ethernet throughput is reduced first so as not to affect TDM traffic. In addition, the overall effect of the automatic adaptive rate feature is increased quality of both TDM and Ethernet traffic, since retransmissions of error packets are performed at lower rates, and therefore less susceptible to interference. Whenever a rate reduction is necessary, both (a) the degree of the reduction is as small as possible to maintain the link and (b) the amount of time that the link operates at the lower rate is as short as possible. The link automatically returns to the maximum available throughput as soon as conditions allow. In most cases, the user does not experience noticeable effects.

Benefits

- A more robust link that stays up even in interference-laden environments
- High performance TDM delivery with added resilience to interference
- Optimized throughput in adverse conditions.

Automatic Adaptive Rate Example and Technical Details

Let's look at an example: An Ethernet link is transmitting at an air interface rate of 36 Mbps (16QAM Modulation), yielding a net throughput of 13 Mbps, with an average PER of 10%. While maintaining the 36 Mbps air interface, the system checks what the PER would be at an air interface of 24 Mbps, which would yield a net throughput of 8.5 Mbps with 1% PER. The link calculates the net difference and decides on the optimal rate. In this case, (1-PER) x (Air Interface) = 11.7 Mbps, which is greater than the lower rate (8.4 Mbps). Therefore the link continues to transmit at the higher rate, despite the higher PER. More generally, the feature operates according to the following rules:

Let P_R be the Packet Error Rate of Rate R

Let T_R be the theoretical Ethernet throughout of Rate R

The Net throughput of Rate R is N_R

$N_R = (1 - P_R) \times T_R$

$P_{36} = 10\%$, $P_{24} = 0.1\%$

If $T_{36} = 13$ *Mbps*, $T_{24} = 8.5$ *Mbps*

The system optimizes the throughput by constantly checking if $N_{R+1} > N_R$.

For TDM traffic, there is an additional mechanism that ensures the TDM quality is not affected by packet errors. The system constantly evaluates the PER of the lower and higher rates. If there is an error in the transmission of one or more TDM packets, the air interface rate is immediately lowered to the maximum acceptable PER air interface rate to retransmit the error packets. After all error packets have been transmitted successfully, the link returns to the higher rate. This entire process occurs in a matter of milliseconds and does not compromise the integrity or synchronization of the TDM traffic.