WHAT IS PACKET MICROWAVE?

EXECUTIVE SUMMARY

This white paper provides a definition of Packet Microwave radio systems and demonstrates how these systems along with Hybrid radio systems are providing an ideal solution for wireless backhaul for next generation mobile broadband networks.

Packet Microwave platforms offer highly scalable solution that leverages new technology features to enable higher throughputs to keep pace with expected growth in demand.

Hybrid microwave solutions can also support all required Packet Microwave features but add crucial support for native TDM for ongoing legacy traffic needs, giving operators the best of all possible network migration solutions in a single platform.

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INTRODUCTION

The growth in mobile broadband services is driving a sea change in the technologies employed to build and operate mobile networks. In particular, the introduction of all-IP transport promises to replace traditional time division multiplexed (TDM) networks to provide network scalability and lower operational costs. To support this network evolution, a new class of licensed microwave backhaul solutions has been introduced to the market, known variously as Packet All-IP or Next Generation radios.

What characterizes these new products, and how do they differ from the Hybrid radios that are already on the market? Are they really different or in some way more suitable for 4G/LTE/WiMAX backhaul networks, as has been suggested?

NEXT GENERATION MICROWAVE RADIO FEATURES

So-called Next Generation radios are designed—not surprisingly—to support Next Generation broadband networks and have evolved a set of features that take advantage of the packetized nature of Ethernet/IP traffic to make maximum use of the available licensed spectrum.

Next Generation microwave features generally include all or a combination of the following:

- Software scalable high capacity, with throughputs of 1 Gbit/s or more in a single radio channel
- Native IP transport with built-in Layer 2 Ethernet switching
- Intelligent use of spectrum using Adaptive Coding and/or Modulation, combined with co-channel operation with XPIC
- Legacy TDM traffic supported natively (hybrid) and/or using emulation technologies such as Pseudowire (PWE)
- Packet synchronization support (e.g., IEEE 1588v2, Synchronous Ethernet)
- Advanced OAM (Operations, Administration, and Management) to ITU-T Y.1731, IEEE 802.1ag and IEEE 802.1ah
- Support for one or more architecture choices, including all-indoor, split-mount and all-outdoor

DEFINING PACKET MICROWAVE

There is no industry standard definition of what constitutes a Packet Microwave radio, which has led to a variety of claims from various vendors. To provide an answer, it is helpful to examine what is *not* a Packet Microwave radio.

To support the emerging need to transport Ethernet/IP, traditional microwave of the type found on the market before 2003, typically relied upon external adapters that encapsulated Ethernet packets within TDM frames, whether that was E1/DS1 or virtual containers in the case of SDH/SONET. This service adaptation was inefficient, involving additional overhead that wasted RF bandwidth and introduced latency. Despite what some vendors claim, not a single vendor on the market still offers this type of solution for Ethernet transport.

In contrast, Packet Microwave has been on the market in one form or another for some time. Beginning around 2003, microwave products became available with integrated Ethernet interfaces (i.e., 10/100/1000BaseT), which enabled Ethernet packets to be mapped directly onto the radio airframe, without any encapsulation, which is the fundamental definition of a Packet Microwave radio.

In all microwave systems, the payload needs to be prepared for transport over the air, since the modulator can only handle data in pre-defined lengths. So whether the traffic is TDM or Ethernet/IP packets, the payload is prepared by dividing it into blocks, or airframes, to which proprietary data is added for link management, NMS and Forward Error Correction (FEC), as shown in Figure 1. FEC enables the radio to self-correct a certain number of propagation-induced errors. The more FEC bytes added, the more errors corrected, giving a better receiver threshold performance but at the expense of radio throughput.

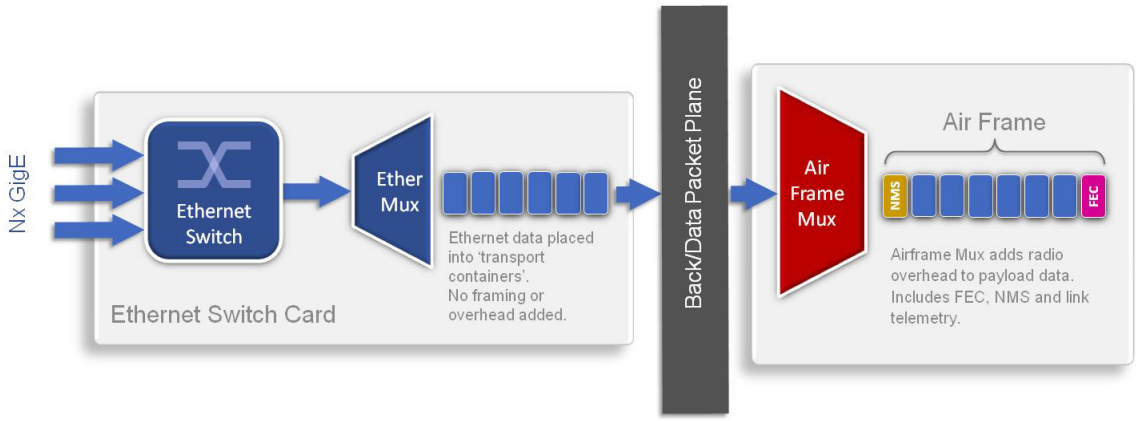

Figure 1. Packet Microwave mapping of Ethernet/IP data into the radio airframe

CAN HYBRID SYSTEMS SUPPORT PACKET MICROWAVE FUNCTIONALITY?

Hybrid microwave systems combined the traditional features of TDM transport with the ability to transport Ethernet/IP traffic natively over the same radio path. These systems enabled Native Mixed Mode transport of both TDM and Ethernet traffic, so that operators could support the backhaul of new IP-enabled base stations deployed alongside their existing 2G or 3G TDM sites.

Even though they retain the TDM transport capability, Hybrid systems support the same Next Generation Packet Microwave transport features, with high throughput and low latency, along with integrated Layer 2 switching. As shown in Figure 2, Hybrid radios simply add side-by-side processing of TDM data, without any encapsulation of Ethernet/IP over TDM and without emulation of TDM over Ethernet/IP.

Hybrid systems are ideal for operators who want a gradual migration path to all-IP and retain a large amount of TDM traffic support, which will not be decommissioned any time soon. Hybrid systems enable operators to seamlessly introduce IP transport at their own pace, without disruption of TDM-based voice services, for low cost and low risk network evolution.

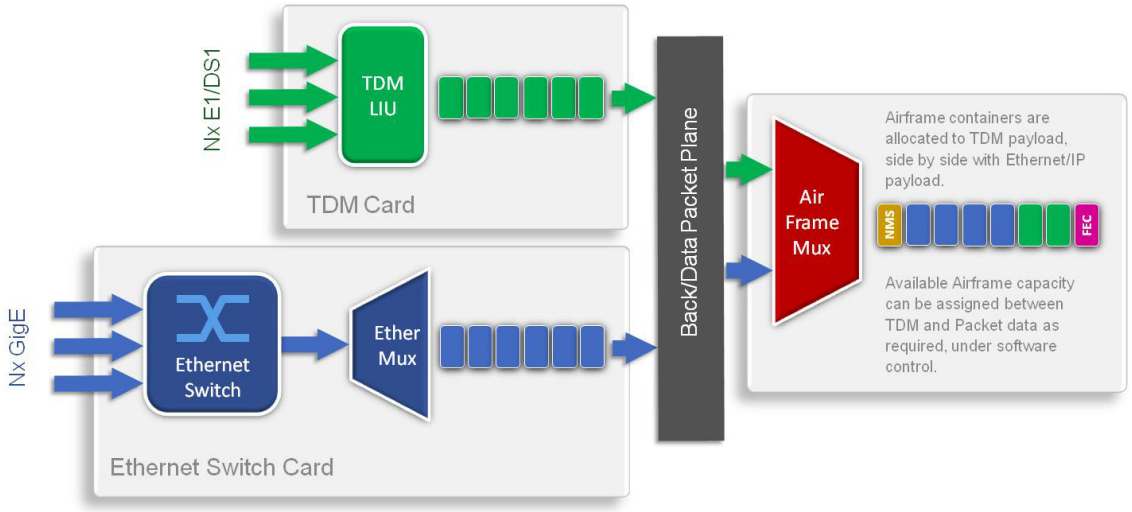

Figure 2. Hybrid Microwave mapping of TDM plus Ethernet/IP data into the radio airframe

ALL-IP OR IP-ONLY?

Packet Microwave systems are often referred to as all-IP, but really they should be called IP-only, in that they support native Ethernet/IP transport but lack any native TDM capability. Instead, these systems are primarily designed for green-field IP networks, where there is no legacy network in place. This is ideal for new WiMAX or LTE broadband networks, but in practice most mobile networks have substantial TDM traffic for legacy 2G and 3G base stations.

As a result, Packet Microwave systems offer the ability to support TDM traffic using new circuit emulation technologies, such as Pseudowires (PWE), which mimic circuit-based TDM connections over an all-IP network. Circuit emulation introduces additional overhead and latency, so it is more suitable for when TDM traffic volumes are relatively low, or can be deployed at aggregation nodes, where TDM traffic from multiple base stations can be optimized and then transported further back over an all-IP transport link.

GIVING OPERATORS ARCHITECTURE CHOICES

Mobile operators need the ability to choose the transport solution that meets their specific needs at that particular stage of their network migration (Figure 3). This is reflected in numerous tenders issued for next generation wireless backhaul by major Tier 1 operators in the U.S. and Europe.

There is no one-size-fits-all solution that meets the needs of all these operators, which takes into account the technologies they have deployed in their network and their desired pace to migrate to all-IP. Many microwave solutions force operators to make a risky leap to all-IP, because they do not provide support for native TDM.

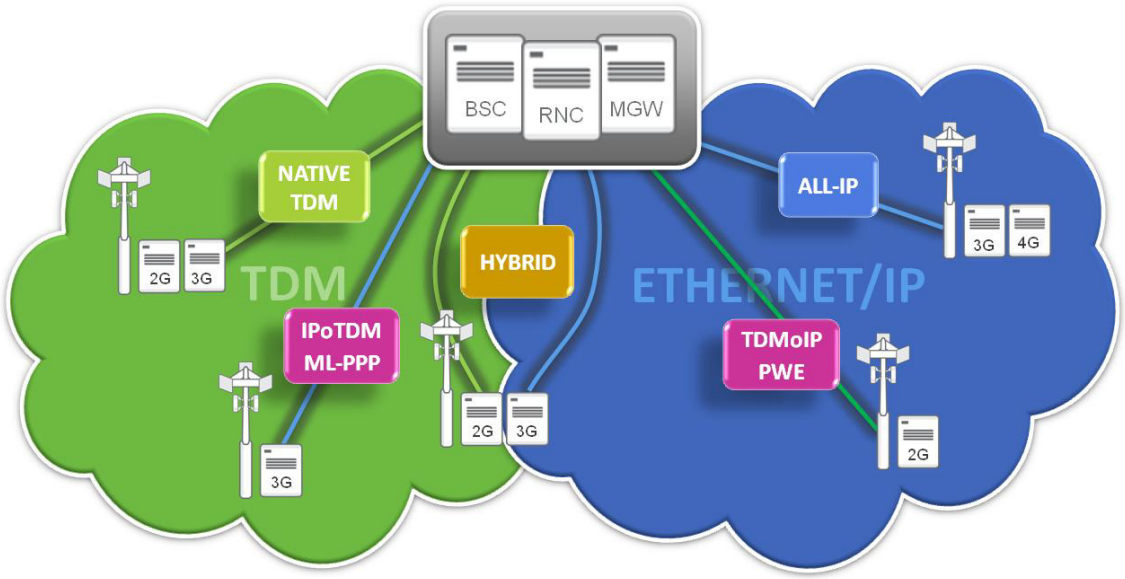

Figure 3. Mobile backhaul transport architecture choices

Operators can more effectively leverage their existing network investments when they can migrate to all-Ethernet/IP at their own pace. They can also avoid the need to make wholesale equipment change-outs just to support new packet transport needs, lowering new CAPEX investments and minimizing network disruptions.

CONCLUSION

Packet Microwave platforms offer a perfect solution for wireless backhaul applications for Next Generation mobile networks, providing a highly scalable solution that leverages new technology features, which enables higher throughputs to keep pace with expected growth in demand.

Hybrid microwave solutions can also support all required Packet Microwave features, such as high packet throughput with low latency, integrated PWE, packet-based synchronization and advanced OAM. In addition, Hybrid systems also include native support for TDM for legacy traffic, giving operators the best of all possible network migration solutions in a single platform.

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