To: Dr. Shaohua Yu
ITU-T SG 17 Q7

Cc: Mr. Herbert Bertine
ITU-T SG 17

Cc: Mr. Peter Wery
ITU-T SG 15

Cc: Mr. Ghani Abbas
ITU-T SG 15 Q9

Cc: Mr. Gilles Joncour
ITU-T SG 15 Q11

Subject: Comments on ITU-T SG17 documents:
COM 17-21-E, COM 17 – D 59.
Draft New Recommendation X.msr. "Link Encapsulation Protocol (LEP) used to Multiple Services Ring (MSR)"

Dear Dr. Yu,

1 Introduction

Thank you for inviting IEEE 802.17 to submit comments on your document Draft New Recommendation X.msr. "Link Encapsulation Protocol (LEP) used to Multiple Services Ring (MSR)". We have reviewed both the consent version, as well as the proposed revisions ITU-T SG17 COM 17-21-E and ITU-T SG17 COM 17–D59.

This liaison is divided into four parts:

- Background on the IEEE 802.17 RPR project;
- Comments on the relationship between ITU-T Q 7/17, ITU-T Q 9/15 and IEEE 802.17;
- Specific technical comments on the referenced drafts;
- A recommendation for moving both standards forward.

We believe that a closer coordination of our work efforts continues to be most critical as a result of the similarities between the work of ITU-T SG 17, as reflected in TD2053, COM 17-21-E and COM 17–D59, and the charter of IEEE 802.17.

2 IEEE 802.17 Background

The IEEE 802.17 Resilient Packet Ring (RPR) Working Group was formed with a charter to develop an RPR standard in December 2000. We meet every two months and have on the order of 100 participants at each meeting. The IEEE 802.17 RPR standard development efforts have benefited from the extensive efforts and contributions of over 50 companies including carriers, system vendors, silicon vendors and universities, and from the participation of over 400 individuals, world-wide. Between meetings we develop and review drafts. We just completed the review of our fifth draft (IEEE P802.17/D1.1) and have authorized the chief editor to create IEEE P802.17/D2.0 and to begin a Working Group Ballot.

The drafts are subject to intensive scrutiny, analysis, simulation and hardware modeling. It is our expectation that this effort will result in a standard that fully addresses our projects objectives. In addition, it will be fast-tracked as an international ISO/IEC standard, with world-wide reach. By visiting our web site http://grouper.ieee.org/groups/802/17/ you can review the hundreds of detailed contributions, representing thousands of hours of work by carriers, equipment and chip providers, and technical universities from around the world that have formed the basis for our current draft.

The charter of the Working Group is to create an RPR standard that will address transport of multi services that includes data, voice and video. Our technical approach is to use both provisioned and dynamic bandwidth management mechanisms for carrying multi services over RPR with the required bandwidth and delay assurances. In addition, RPR will maximize bandwidth utilization for opportunistic traffic such as Internet traffic.

RPR provides a flexible protection mechanism that supports meeting SLAs for multi services in under 50 ms. The wrap based protection switching mechanism in RPR provides a minimized packet loss for data services whose SLA attributes for network availability are usually a function of packet loss. The steering based protection mechanism provides somewhat simpler hardware. Both mechanisms can provide guarantees of no packet reordering, which is useful for emulating voice and TDM emulated services and is required to support 802.1D bridging. These features highlight RPR's commitment to multi services. Furthermore, when deployed as part of a SONET/SDH ring network, a portion of the ring BW can be provisioned for traditional TDM services, with a portion reserved for RPR services.

An objective for RPR is to provide an out-of-box plug-and-play experience that requires no provisioning or configuration of RPR nodes to attain an operational state of the RPR network. Hence, RPR is targeted for world markets that have access to pool of labor with very minimal qualifications to configure, provision and monitor RPR networks.

RPR is physical layer agnostic enabling it to operate over SONET, SDH, Gigabit Ethernet or 10 Gigabit Ethernet physical layers, as well as other physical layers to be defined. This flexibility will permit the integration of RPR into a variety of existing and newly emerging optical transmission technologies.

As a part of 802 standards, RPR will operate with existing bridging and routing protocols with no changes required to either. This capability will enable seamless integration of several video multicast schemes proposed over IP. Since RPR will support current 802.1D bridging, it can be used to offer Ethernet based layer 2 services with no changes to existing Ethernet equipment.

The proposed RPR standard also includes Layer 2 OAM that enables root cause analysis and fault isolation on optical networks. This feature allows the flexibility for the optical transmission layer to retain its OAM&P scheme while providing a better resolution of failures. It also speeds up fault isolation.

The proposed RPR standard is also specified with flexibility in implementing RPR nodes in terms of buffer capacity required. This flexibility will allow for cost trade-offs in RPR box design based on application requirements.

3 Relationship between ITU-T Q 9/15, Q 7/17 and IEEE 802.17

In response to liaisons from ITU-T Q 9/15, IEEE 802 and IEEE 802.17 a joint meeting was held on July 23/24 2002 in Oslo, Norway. The report from that meeting is available as COM 17-D49.

The conclusion of the report was that there was overlap between the X.msr project, the IEEE 802.17 RPR project and work being done within Q 9/15. Furthermore, it was recommended that close liaison occur between the three groups as 75% of the features are of common interest.

The Chair of the IEEE 802.17 WG invited Dr. Yu to attend the September Interim meeting in New Orleans, Louisiana. This would have been an excellent opportunity for discussions to align the work being done in both standards groups. Unfortunately, Dr. Yu's schedule did not permit his attendance, nor did anyone from Q 7/17 announce their attendance at the meeting.

While there has been some informal email between the chairs of Q 7/17 and IEEE 802.17, given the formal nature of standards development it is not the appropriate forum to resolve issues.

Therefore, it is the view of IEEE 802.17 that insufficient liaison work has occurred between our groups to resolve the question of overlap between our standards.

4 Technical Comments on Proposed Draft X.msr

The following comments are IEEE 802.17's technical concerns that highlight areas of deficiency or overlap in the current draft of X.msr.

Recommendations and/or the equivalent feature or function from RPR is described and indicated in italics.

4.1 Lack of Layered Design Approach

Designing a protocol in a layered model is considered a best practice in both industry and the academic world. The X.msr draft does not follow a layered approach to protocol design consistent with the OSI model of networking.

Since X.msr involves multiple layers of the OSI protocol stack, IEEE 802.17 can only comment on aspects of the protocol that are gleaned to be layer 2 (data link layer). Other aspects of the X.msr protocol which are gleaned to be above layer 2 should be referred to other standards groups and we will make suggestions on the appropriate standards bodies.

It is the opinion of IEEE 802.17 that the X.msr draft defines both a MAC layer and a service layer above the MAC. The frame format, topology, ring protection, bandwidth allocation and frame reception rules are the basis of the MAC. Our view is that the tributary services are another distinct layer above the MAC that may be covered by IETF, MEF and ITU.

In comparison, the RPR Draft contains many diagrams showing the relationship of the 802.17 standard with other layers in the protocol stack, and shows the relationship between sublayers of the MAC itself.

The joint Oslo meeting concluded there was a large degree of overlap between X.msr and RPR. This overlap was not within the Tributary definitions, but rather the MAC layer description. The IEEE 802.17 MAC proposal includes all of the functionality required by X.msr and additional functionality to achieve the broader scope and applicability of the RPR project.

In comparison, the service layer as defined in X.msr is outside of the scope of RPR but it is the belief of IEEE 802.17 that the service layer of X.msr can be supported by the RPR standard as a client.

4.2 Use of Ethernet MAC Layer

There are several issues with the use of the 802.3 Ethernet MAC and PHY as detailed in COM 17-D59.

4.2.1 Mapping of LEP to Ethernet

The final paragraph of Section 1 page 7 indicates that "This Recommendation does not specify the method of mapping LEP protocol to FE/GE/10GE."

It is critical that the X.msr draft completely specifies the mapping of the LEP frame into the Ethernet frame. The Ethernet MAC has a well defined interface between the MAC and the client layer which includes specifying the 48-bit Destination Address, 48-bit Source Address, Protocol Type/Length and the client PDU.

If X.msr is not actually using the Ethernet frame structure, but is using only the PHY layers, then the overlap with RPR is clear.

4.2.2 Operation of Uni-directional Ethernet PHY Layers

The X.msr draft implicitly uses uni-directional Ethernet physical layers. The Ethernet MAC stipulates bi-directional symmetrical physical links.

The IEEE 802.17 draft is currently defining a 2 fiber ring. However, the WG passed a requirement that the 802.17 MAC must be able to support 2N ringlets. Presentations have been made to the WG on techniques such as ring aggregation which are analogous to IEEE 802.3ad Link Aggregation. Therefore, IEEE 802.17 has every expectation to support systems with any number of 2 fiber rings.

4.2.3 Operation of L2PS

Section 3.12 specifies Layer 2 protection switching based on tributary failures using an Ethernet MAC. The scheme utilizes detection of idle bytes, IPG or the lack of receipt of data within 20 milliseconds. The Ethernet MAC does not make the reception of idle bytes or IPG visible to the client.

RPR has defined a mechanism for the MAC to notify the client of any span or node failures on the ring.

4.3 MSR Scheduling Unit and Transit Path

The X.msr draft does not define the algorithm for transmit packet selection, nor does it define the design of the transit path. As such, it is not clear that a jitter or delay bound can be specified.

RPR specifies the exact algorithm for transmit packet selection and the abstract design of the transit path. Therefore, a clear jitter and delay bound can be *specified for the traffic. Additionally, RPR supports both provisioned traffic (pre-planned) and opportunistic traffic (fairness).*

4.4 Frame Format

The X.msr draft uses a frame format that blurs the separation between protocol stack layers. Features / fields required for MAC service should be separated from client features. Were the X.msr protocol to be layered, the MAC frame is clearly an operational subset of the RPR frame format. In fact, the X.msr frame is lacking in features that are important in building multi-service packet ring networks.

The following sub-sections detail some of the areas in which the X.msr specification is lacking in features and/or not functionally.

4.4.1 TSN and TT

The OSI protocol layering within the Tributary component of X.msr is blurred, as shown by the placement of TT and TN within the MAC specific fields. The tributary type and tributary number refer to entities within the X.msr node that are above the MAC layer. These fields belong in the payload of a MAC frame rather than the header.

In an 802 model, X.msr would be assigned a unique Ethertype value and the X.msr frame would be defined as a client of the MAC. The TT and TN fields would clearly be part of the client frame.

31:16	15:0
RPR_CTRL1	DA[47:32]
DA[31:16]	DA[15:0]
SA[47:32]	SA[31:16]
SA[15:0]	RPR_CTRL2
HEC[15:0]	EtherType = X.msr
DATA[N*8bits]	
FCS[31:0]	

Note: RPR frames are not 32-bit aligned, the FCS can start on any byte boundary and is shown aligned in this diagram for convenience.

As the X.msr protocol evolves over time with new services / features, the MAC layer definition would not have to change, as the design of the X.msr payload is outside of the scope of 802.17.

4.4.2 HEC protecting the MAC header

The X.msr frame format does not contain an HEC field that protects the MAC header information. As X.msr is intended to carry TDM emulated packets, there is a significant voice quality performance penalty when an entire TDM packet must be discarded due to an FCS error. Compare this to SONET/SDH equipment where a single bit error affects a single DS0 connection. In the case of packet based transmission, the same bit error will cause N DS0 connections to suffer a missed byte.

RPR solves this problem by protecting the MAC header with an HEC field. This allows delivery of the packet if the addresses are known to be good, but the FCS is in error. Thus it is only in the case of the header being corrupted where voice samples are lost.

4.4.3 Source Address Field Missing in COM 17-21

The X.msr frame format does not contain a source address field. This field is necessary as part of the mechanisms which insure that duplication of packets cannot occur. The majority of scenarios detailed in the Time To Live section below could be solved with a Source Address Field.

RPR contains a source address field and has stripping rules to prevent reorder and duplication.

4.4.4 Time To Live field in COM-17-21

The X.msr document is inconsistent with regard to the size of the TTL field. This field is described as both a 5-bit and 6-bit wide field in various parts of the document.

The X.msr document does not clearly state how TTL is set when a data packet is being added to the ring at a source node. It appears, that the TTL value should be set to the number of nodes on the ring (based on provisioning) or to twice the number of nodes on the ring if there is a wrap on the ring.

The IEEE 802.17 Bridging Adhoc has spent extensive time studying the issues of reorder and duplication and has a robust solution that would apply to X.msr.

4.5 Types of Multi-Services in Tributaries

In table 1 (of COM 17-D59) three types of multi-services are defined. Full duplex pt-pt, half-duplex multicast and broadcast.

We recommend that a liaison with IETF to insure the proper support of IP protocols via X.msr. It is our understanding that these protocols expect full duplex multicast and broadcast datalinks.

5 Recommendation for Progress on Both Standards.

IEEE 802.17 believes that an almost complete overlap of MAC layer functions exists between RPR and X.msr, and that IEEE 802 is the appropriate forum for specification of these functions. Furthermore, IEEE 802.17 WG is fully supportive of the specification of tributary services by Q 7/17 as a client to the proposed IEEE 802.17 standard.

We continue to encourage participation of members of Q 7/17 in the RPR WG to work with us on the specification of the MAC layer to support X.msr functional requirements. The RPR WG has agreed that it would be willing to initiate joint work with Q 7/17 to review the requirements of X.msr so that the proposed IEEE 802.17 standard can accommodate these. We offer our help in approaching the IEEE RAC for allocation of an Ethertype for X.msr.

The IEEE 802.17 WG invites you to our next interim meeting in Atlanta January 13-17, 2003 to progess these issues.

Sincerely,
Michael Takefman
Chair IEEE 802.17 Resilient Packet Ring Working Group