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Title:

TG3 Functional Requirements vs. TG1 Air Interface draft standard - MAC

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Source:

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Base Document:

Purpose:

Outline the differences between the TG3 functional requirements and the TG1 proposed MAC

Comparison between TG3 FRD and TG1 proposed MAC

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Contents

- Essential FRD differences
- Expected difference in behavior
- TG1 MAC disadvantages from TG3 perspective

TG1, TG3 FRD

- TG1: Document IEEE 802.16.s-99/00r1
- TG3: Document IEEE 802.16.3-00/02r3

- “MAY” requirements not discussed here

Essential FRD differences - 1

	TG1	TG3
Market	**Business** **Multi-dwell**	**Residential** **SoHo** **Small business** **Multi-tenant**
Services	**Legacy telephony** **Audio/Video Multicast** **ATM** **IP**	**IP** **Bridged LAN** **Packet based voice**
Peak data rate	**155Mb/s**	**10Mb/s***
Minimum delay	**5ms**	**>>**

Essential FRD differences - 2

	TG1	TG3
Classes of Services	**ATM classification:** **CBR (SDH/PDH)** **VBR (VoIP, video)** **ABR(variable BW)** **UBR(best effort)**	**IETF DiffServ classification:** **EF(VoIP,video)** **AF(ISP service differentiation)** **BES(best effort)**
Typical channel width	**25MHz***	**3-3.5MHz**
Cell max. radius	**3km***	**50km**
ARQ	**N.A.**	**YES**

* - resulting from other considerations

Expected differences in the behavior of the TG1 and TG3 systems – 1

Why	TG1	TG3
Residential vs. business	**Large traffic pipes, always caring data, pseudo-static character**	**Mostly random pipes**
Legacy vs. IP	**Low delay is required (1ms frames)**	**Delay less critic**
Bridged LAN	**-**	**Requires 802.1d addressing for bridge support**
High vs. low data rate	**Low transmission time per packet**	**Long transmission time, more than 1ms for long IP packets**

Expected differences in the behavior of the TG1 and TG3 systems - 2

Why	TG1	TG3
Short vs. long distance	**Short contention period**	**Long contention period**
Variable length IP datagrams support	**Segmentation may be used**	**It is recognized that segmentation is spectral inefficient and should be avoided**
ARQ	**No support** **Hard to introduce due to the "policy rules"**	**Required**
ATM vs. IP QoS classification	**Hard, 1ms, framing** **TG1"policy rules"**	**Flexible framing, longer intervals** **TG3 "policy rules"**

TG1 MAC DISADVANTAGES

(from TG3 perspective)

TG1 MAC is PHY dependent

- The MAC is adapted for the QAM modulation
  - Mini-slot is defined in number of QAM symbols
  - The header is transmitted in QAM 4
  - The equalizer parameters are for QAM, line-of-sight operation
  - Adaptive modulation support is defined for QAM

1 ms frame duration

- Too short for IP variable packet length support
  - 1.7ms for 3.5MHz, 2bit/s/Hz, 1500bytes frame
- Too short for TDD support
  - Both Rx and Tx in 1ms!
- Too short to accommodate the contention period, with 50km distance
- Too short tom accommodate delay for 50km (150us)
  - causes registration slots to waste a lot of BW ; these are often used with residential deployment

No flexible framing

- Framing is problematic with IP traffic
  - Long frames = long delay
    - QoS problems
    - TCP/IP throughput problems
  - Short frames = short delays
    - Require fragmentation
    - Spectral efficiency problems

No fast BW allocation

- Many CPE units with random data demand require fast BW allocation, as opposed to small number of users using legacy services
- Slow (pseudo-static) and centralized BW allocation mechanism: request, allocation, very demanding BST central processor performance

No Acknowledge frames

- Contrary to FRD-TG3
- ARQ require fast variable BW allocation, which is against the TG1 “policy rules” philosophy

No retransmission support

- Rx/Tx policy per service limitation
- The BW allocation is quasi static, except the Best Effort Service
- The “policy rules” can accommodate retransmissions only for BES

VoIP VAD support

- BW requirements are permitted only in contention periods – may be unsuccessful
  - Against QoS concepts!
- Not suitable for relatively long compression intervals, demanding fast BW allocation for efficient support

Multicast and LAN-to-LAN bridging support

- Addressing mode: based on connection_ID of the final destination, not on the MAC address
- No mechanism to allocate a LAN address to a connection_ID
- Makes the bridge implementation non-standard and difficult
- Introduces significantly delays in bridge
- Lowers IP performance

No data polling mechanism

- Data polling needs no apriori knowledge of BW requirements
- Most suitable when combined with IP traffic shaping
- Most suitable for VoIP when VAD is enabled
- Most suitable for external VoIP GW
- Most suitable to support ARQ

Conclusions

- 802.16.1 MAC does not respond to 802.16.3 needs
- 802.16 should decide between two possible approaches:
  - Adopt the existing MAC proposal as 802.16.1 MAC and design a different MAC for 802.16.3
  - Change the existing MAC proposal to be:
    - PHY independent
    - Suitable to both 802.16.1 and 803.16.3