

# **EFM Copper recap**

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## **“The Good, the Bad and the Ugly**

**EFM October, 2001**

**Hugh Barrass (Cisco Systems)**

**with thanks to Howard Frazier (Dominet Systems)**

# EFM Copper Recap

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- **“The Good”**  
Common elements with wide support
- **“The Bad”**  
Contentious issues – to be resolved
- **“The Ugly”**  
Items outstanding – to be addressed

# “The Good”

- **PAR+5**

This defines the area that we are addressing

By implication, it also defines what is “off-topic”

No more need for PAR + 5 support

- **Objectives**

These are a yardstick, against which proposals must be measured

- **Other (I hope) common elements**

These are items I have dredged from the slideware to date

Maybe more can be added to this

# Objectives (EFMCu)

Single pair non-loaded voice grade copper

Distance  $\geq 2500$ ft

Speed  $\geq 10$ Mbps aggregate

- **Restrictions**
  - PHY proposals must meet these minimum requirements
  - Some leeway for interpretation
- **Direction**
  - Going beyond the objective requirements a plus
- **Extensions**
  - More objectives possible
  - Tougher requirements, tighter constraints etc.

# Objectives (2)

Recognize spectrum management restrictions imposed by operation in public access networks, including:

Recommendations from NRIC-V (USA)

ANSI T1.417-2001 (for frequencies up to 1.1 MHz)

Frequency plans approved by ITU-T SG15/Q4, T1E1.4 and ETSI/TM6

- **Restrictions**

This objective recognizes real restrictions which 802.3ah equipment must conform to.

We didn't make these – in many cases we have no choice

- **Public vs Private**

Opportunity for innovative solutions

Handle with care!

# Generally agreed items

- **Simulation environment and test loops**
  - Work in progress with wide support
  - Presentation to follow
- **Randomizer, Forward Error Correction, interleaver**
  - Necessary due to noise environments
  - Reed-Solomon FEC
  - Programmable Ramsey III interleaver
- **Framing with out of band control channel**
  - T1E1.4 framing? Single latency?
- **OAM functions – at a high level**
- **Upstream power back off**
  - Detailed algorithm from ANSI T1?
- **MII & MDIO interfaces**
  - Some things stay the same...

# “The Bad”

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- **FDD vs TDD**
  - ... don't forget spectral management
- **DMT vs QAM**
  - The bug-bear of standards efforts
- **MII → FEC framing**
  - Raw or encapsulate
- **More to come...**
  - Note too much, I hope!

# Duplexing technology – FDD/TDD

- **Frequency Division Duplexing**
  - Method adopted by standards
  - No NEXT
  - Static – simple to model and predict
  - QOS and SLA**
- **Time Division Duplexing**
  - Cheaper front-ends
  - No band pass filtering**
  - Flexible symmetry
  - STDD vs burst mode TDD
- **Presentations to follow**
  - Need to consider public vs private networks



# Line code – DMT/QAM

- **Discrete multi-tone**
  - Flexibility in presence of disturbers
- **Quadrature Amplitude Modulation**
  - Simpler silicon
- **How can we decide?**
  - Poker tournament?
  - Pie baking contest?
- **Deadline for decision?**
  - Could be critical path for 802.3ah
  - Can we proceed anyway (like ANSI T1, ETSI TM6 etc.)

# Framing – raw/encapsulate

- **Raw**

  - **Simpler, cheaper, sufficient**

  - **No bit-stuffing bloat**

  - **Bit rate on the line remains constant**

- **Encapsulation (HDLC)**

  - **Proposed by ITU for PoADSL, PoVDSL**

  - **Protection against delimiter error**

  - **Replaces 8b/10b**

# “The Ugly”

- **Not really “Ugly” – just things left to do**
  - Many more still to be added...
  - Try to move from this list to “The Good” list
- **MIB extension details**
  - OAM – most independent of PHY choices
- **MII rate matching**
  - CSE, clocking, half-duplex, .3x etc...
- **MDI control registers**
  - Locations, definitions, operations etc.
- **Data rates**
  - Choose specific rates or allow variations of parameters?
  - Provision, auto-negotiate or rate adapt
  - Flexibility & ease of use vs stability & QOS/SLA**

# Exhortations!

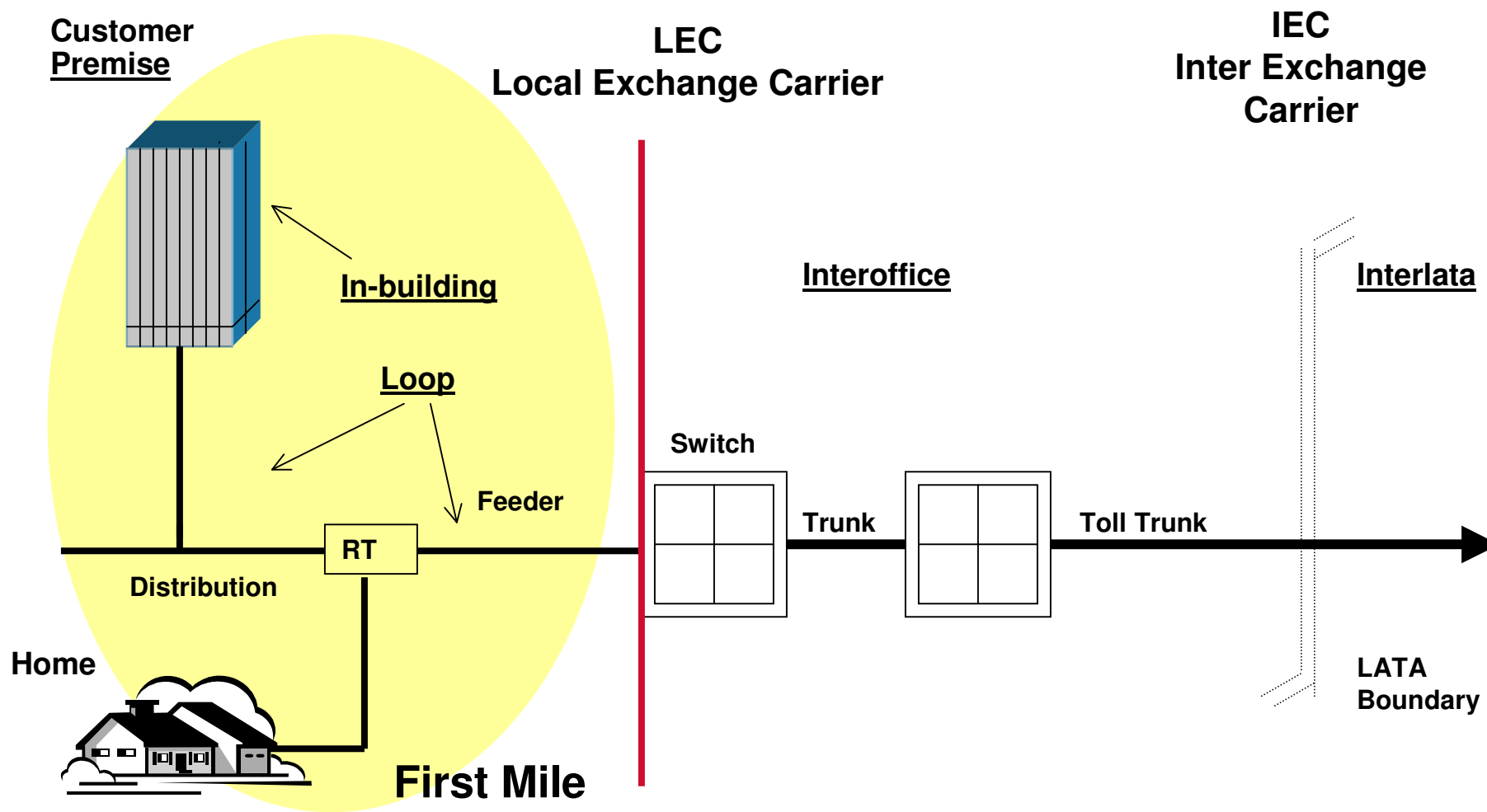
- **Presentations**
  - More detail needed than before
  - Please be conscious of previous material
    - Especially objectives and generally agreed items**
  - Stay on-topic and within scope
- **Consensus**
  - New items, try to build consensus from the start
  - Consider how to make a motion to capture consensus
    - Needs 75% support**
- **Contentious issues**
  - Accentuate the positive – your good points, rather than their bad
  - Strategize towards 75% support
    - Compromise where possible**
  - No new contentions!

# Backup slides

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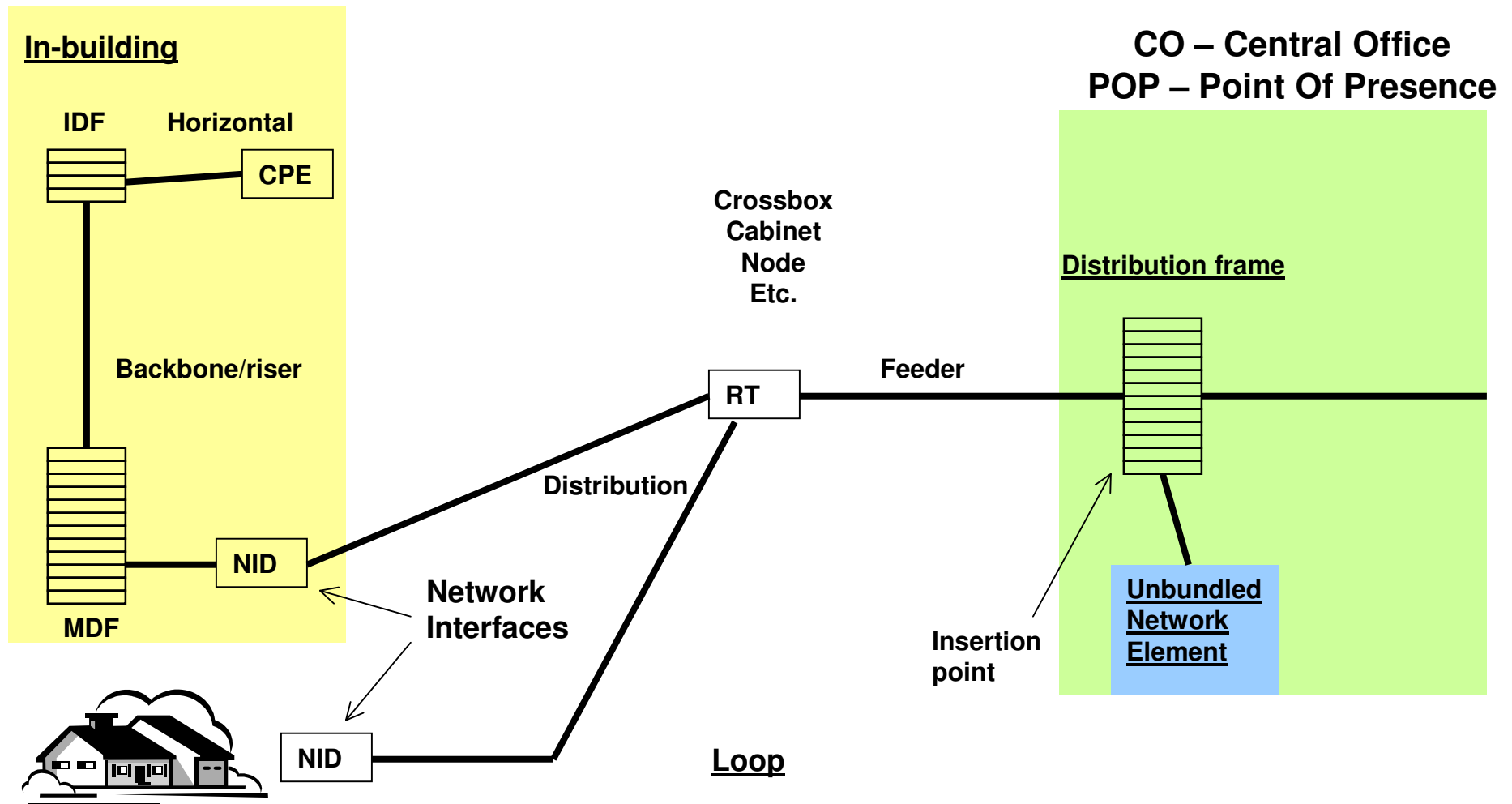
IEEE802.3ah EFM  
September 2001

# Where is EFM copper?



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# Some terminology



# Definitions

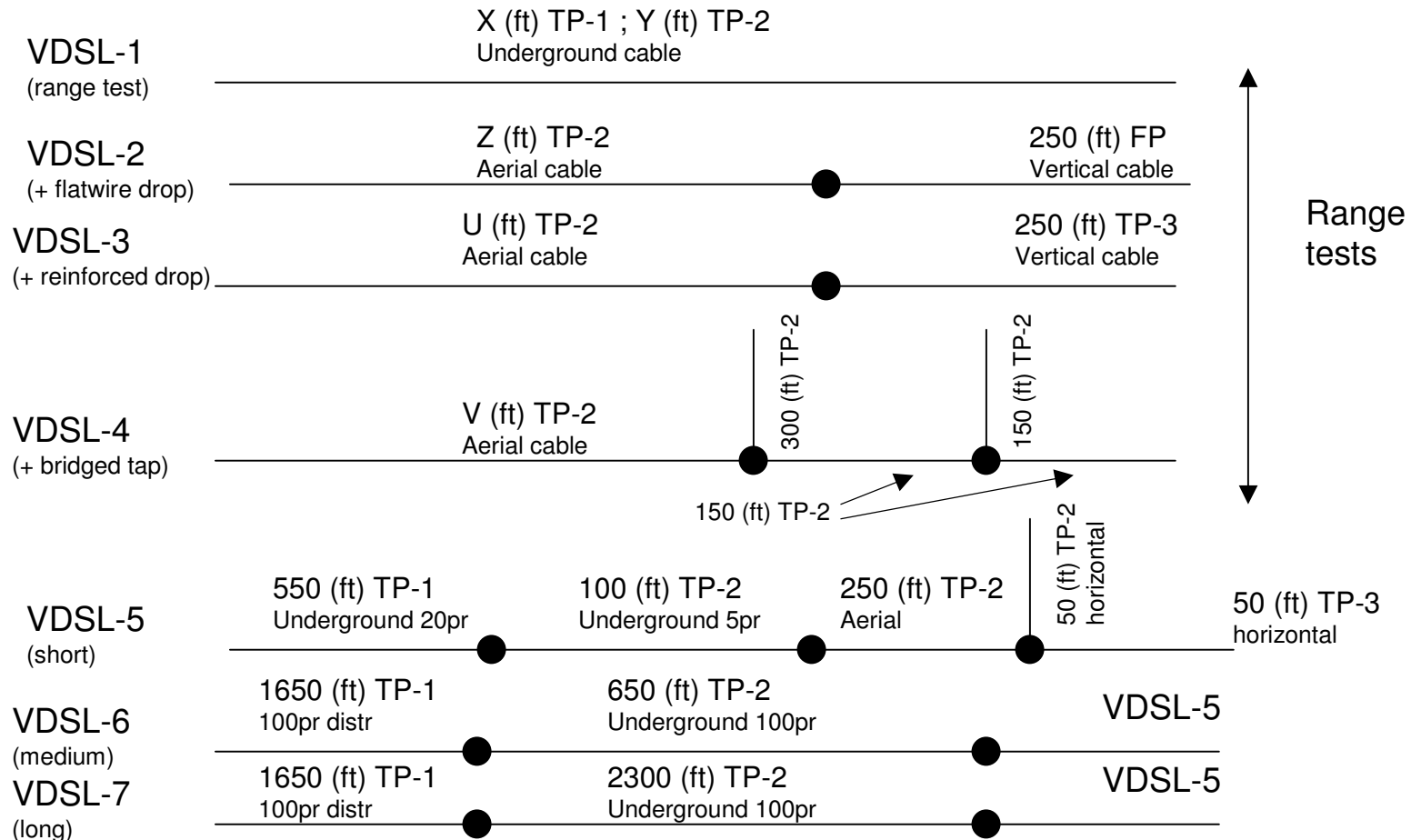
- **Non-loaded**  
Load coil improves attenuation 0-3kHz (kills signals >3kHz!)
- **Voice grade**  
Suitable for transmitting voice, “voiceband” = 300Hz – 3.3kHz
- **Local loop**  
Path between Central Office (DF) and Network Interface
- **In building**  
Un-structured cabling – does not meet TIA 568 etc.
- **Distribution frame**  
Patch panel, punchdown, BixBlock, etc.  
In CO, crossbox – also Master DF in-building, & Intermediate DF between MDF & end user
- **Network Interface – also Demarcation Point**  
Physical or logical point at which the exchange carrier’s responsibility ends and the user’s starts  
(Internal Network Interface – insertion point for unbundled elements)
- **Terminal equipment**  
Equipment connecting to the customer end of the loop
- **Network element (and unbundled network element)**  
Equipment (etc.) in the network provider loop



# T1 Standard Test Loops

- VDSL test loops – designed for data rates in EFM range

Ref T1E1.4/2000-009R3



IEEE802.3ah EFM  
September 2001

# Spectral compatibility for dummies

- **Key definition**
  - ANSI T1E1.4 defines spectral compatibility in T1.417
  - A “must read” for anyone deploying in the local loop or shared environment
- **National Reliability and Interoperability Council (V)**
  - Advisory body for FCC – spectral planning with teeth!
  - In process of adopting T1.417**
- **Why does it matter?**
  - Crucial for unbundling
- **Is it new?**
  - No

# T1.417 “in a nutshell”

- **“In a multi-service installation, services shouldn’t kill each other”**  
Services listed include: voice, ISDN, HDSL, ADSL, RADSL, SDSL etc.  
Ref. 4.3.1
- **“Everybody use defined PSD mask”**  
Includes power, frequency and location/direction  
Safest method  
Ref. 4.3.3
- **...or “Prove that you don’t interfere”**  
“Method B”  
Risk of 2 “method B” services interfering with each other...  
Ref. 4.3.5
- **NRIC-V added an extra clause**  
“If you can, you may listen & adapt to be compliant when you need to be”  
Clause 4 (a)

# References / reading list

- **T1.417**

Seminal work on spectral compatibility and loop characteristics  
(also applicable to unstructured wiring)

T1E1.4/2000-002R6 - <ftp://ftp.t1.org/T1E1/E1.4/DIR2000/0e140026.pdf>

- **ANSI TR-60**

Unbundled Voicegrade Analog Loops – T1A1.7 working group

- **Some others**

ANSI IEEE 820-1992, loop design methodologies, signal levels, and bridged taps.

Standards Committee T1 – [www.t1.org](http://www.t1.org)

AT&T/Bellcore Loop Surveys