

EFM Copper recap

“The Good, the Bad and the Ugly

EFM October, 2001

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with thanks to Howard Frazier (Dominet Systems)

EFM Copper Recap

- **“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 ≥ 2500 ft

Speed ≥ 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”

- **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!

Moving Forward

- **Learn from history!**
“To know where you are going, first understand where you are coming from”
- **Document structure**
Must be addressed soon
- **Baseline proposals**
Competing PMD's and open issues
- **Requests for Austin**
Rate and reach – operational proposals
MAC – PHY rate control (& MIB)

History and Structure

- **GigE & 10GigE presentations on the web**
Look at presentation subjects, formats and evolution
Also look at EPON & P2P progress
- **IEEE 802.3**
Also 802 Overview and Architecture
- **Clauses**
Modify existing, add new
- **Presentations**
Baseline proposals and support
Focus on specific solution
Remember 75%

Rate and Reach Proposals

- **Presume that agreement on curves is forthcoming...**
 - We need mechanism / operational proposals**
 - Some mechanisms may be PMD proposal specific**
- **Multiple rates?**
 - Fixed rate**
 - Discrete rates chosen by system operator**
 - Discrete rates with adaption mechanism**
 - Dynamically adjusted or static?**
 - Continuum – following rate/reach curve**
- **Higher layers**
 - Effects on higher layers of multiple rates**
 - SLA & QOS**
 - Interface mechanisms**
 - Compatibility, liaison?**

MAC – PHY rate control

- **Related to rate mechanism**
 - Complexity must be addressed
- **MII**
 - Use as is
 - Consider options for adaption
 - Modify
 - Compatibility
 - New optional interface
- **Learn from 10G**
 - Options considered (for simpler problem)

Simulation and Test ad hoc

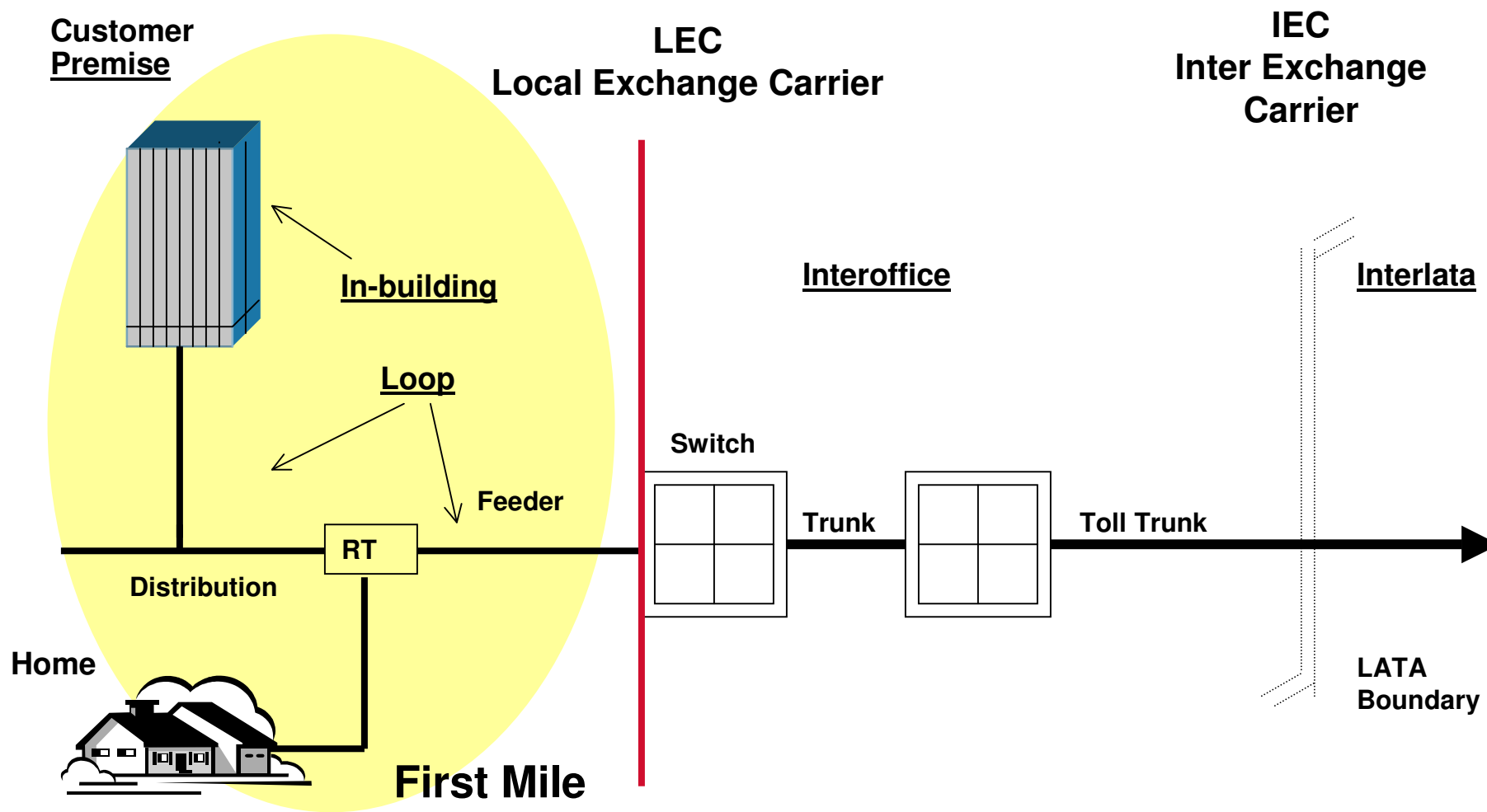
- **Some work started**
 - Behrooz Rezvani leading**
- **Simulation models for cable**
 - Local loop**
 - Leverage existing work**
 - In-building**
- **Environmental models**
 - Noise and crosstalk**
- **Test loops**
 - Based on install base**

Closing discussions

- **New objective**
Howard Frazier
- **Rate mechanism / operation**
Volunteers to kick off
- **Simulation and Test ad hoc**
Behrooz Rezvani
- **AOCuB**
Before we rejoin the main thread

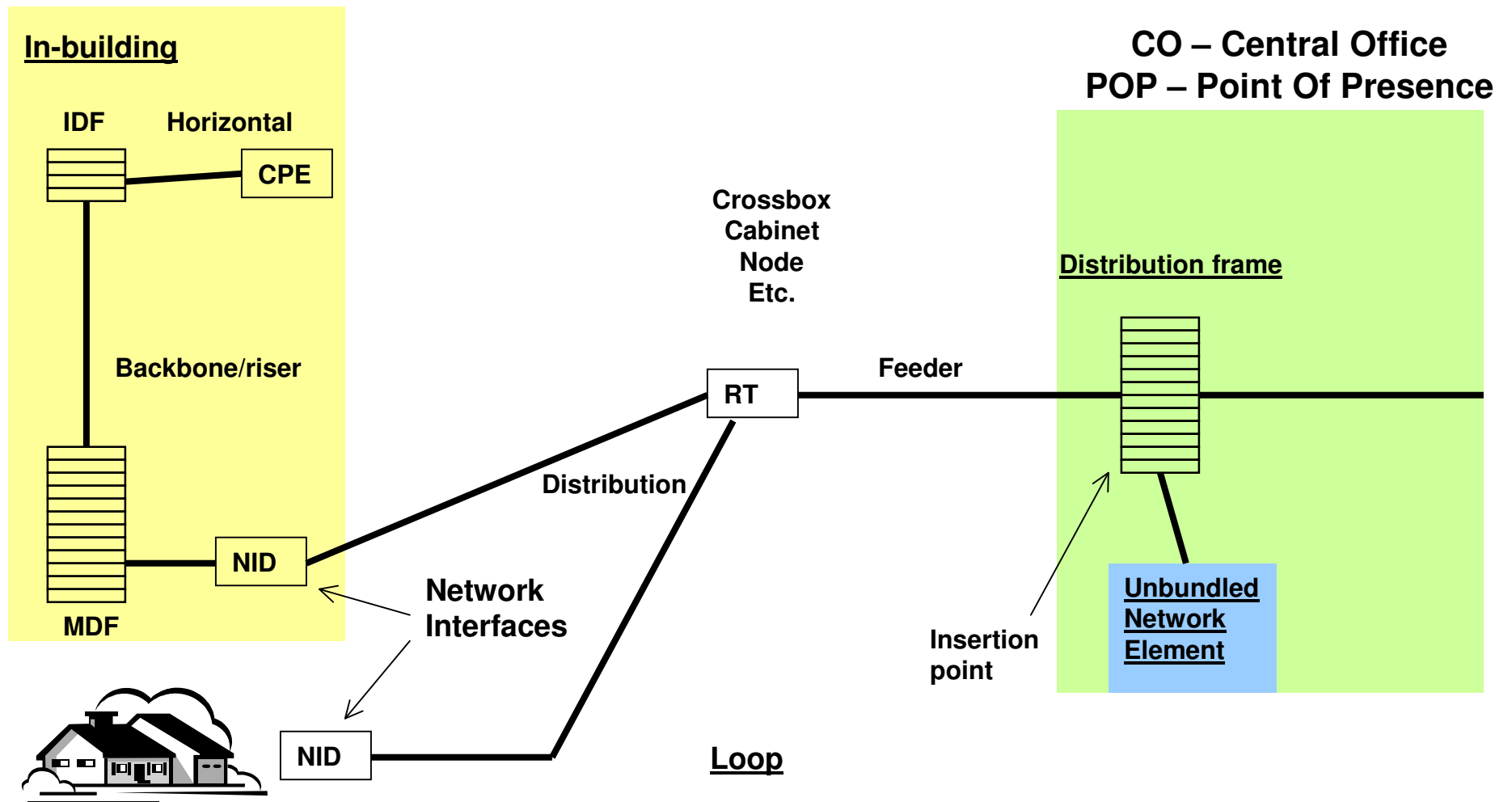
Backup slides

Where is EFM copper?



IEEE802.3ah EFM
September 2001

Some terminology



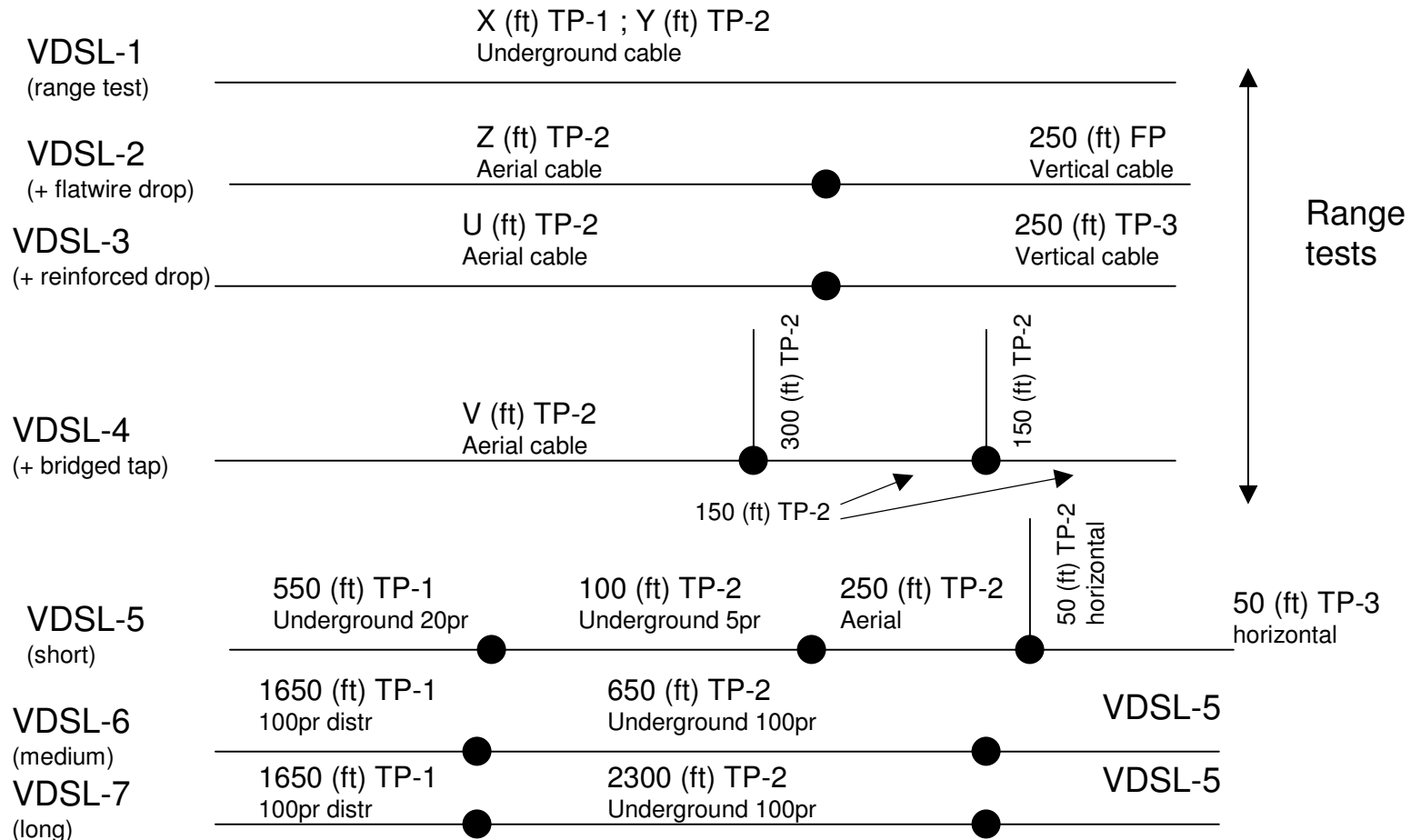
Definitions

- **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

AT&T/Bellcore Loop Surveys