An Application of IEEE 1451.3

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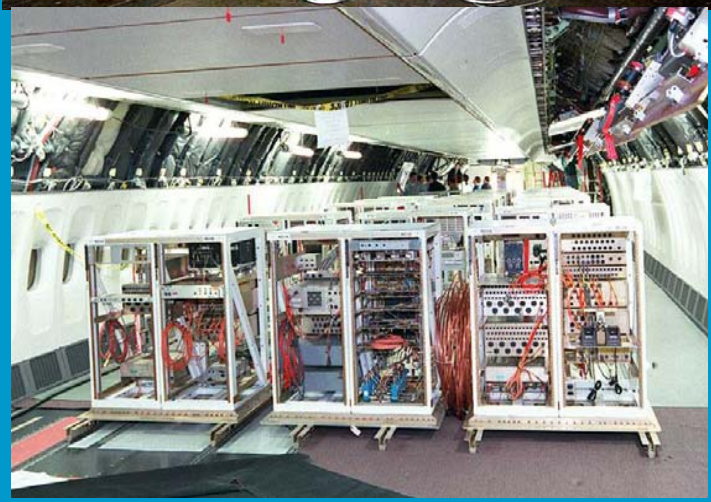
A Real World Problem To Solve

Cabling

- **Massive quantities of cables to connect transducers to data systems in both Flight Test and Lab Test**
- **Typically one cable per transducer**
- **For large tests - miles of cabling**
- **Very costly to build, install, and maintain**

Signal Conditioning

- **In this 777 photo, about half of these racks house analog signal conditioning - those racks are eliminated with smart sensors**
- **Today's signal conditioning costs about $2,000/channel - estimate for smart transducer technology is less than $300/channel**
- **The space required for these racks will be eliminated**
- **Installation costs are reduced**



Tarallax Wireless, Inc.

Key Elements of the 1451.3 Smart Sensor Standard

- TEDS
- Synchronization of Data Sampling
- Unique Identification
- Accessibility to Networks (e.g. Internet)
- Plug-N-Play Sensor Connections
- Comprehensive Command Set

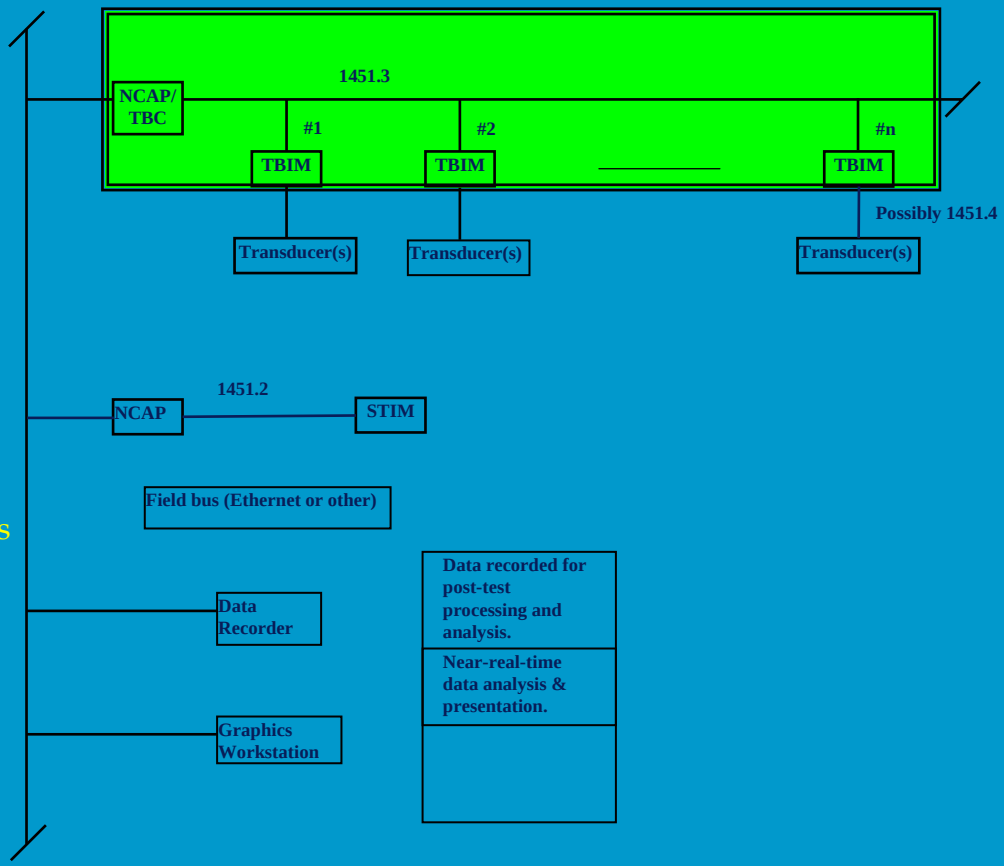
Why A New Standard?

- Accommodates Large Arrays of Synchronized Transducers
- Accommodates An Aggregate of 10's of Mbits/sec from 100's of Sensors
- Power and Data Over a Single Twisted Pair Cable
- Self-Configuring Dynamically-Controlled Network

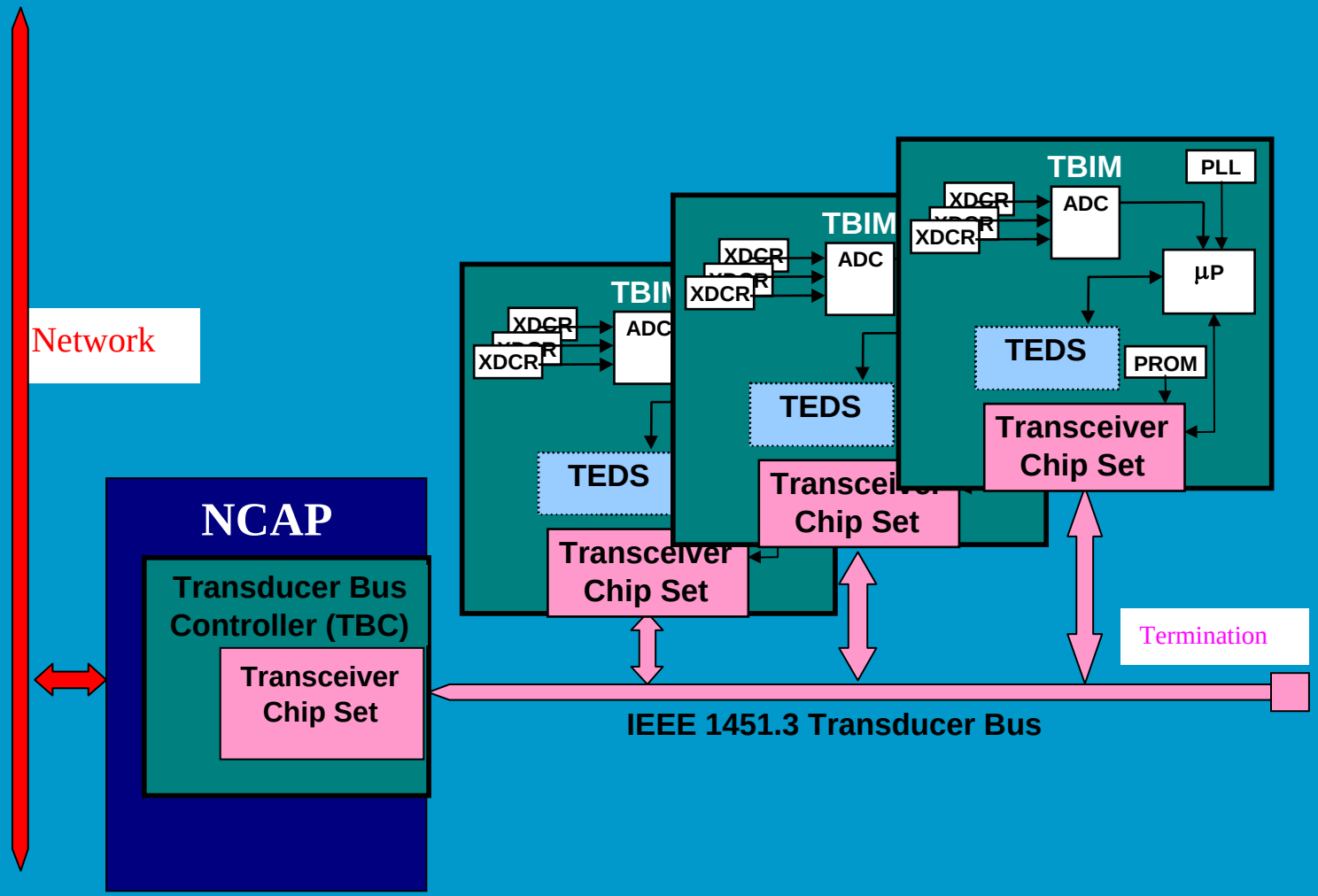
1451.3 Architecture

- NCAP: network capable application processor (µP)
- TEDS: Transducer Electronic Data Sheet
- STIM: Smart Transducer Interface Module
- TBC: Transducer Bus Controller
- TBIM: Transducer Bus Interface Module

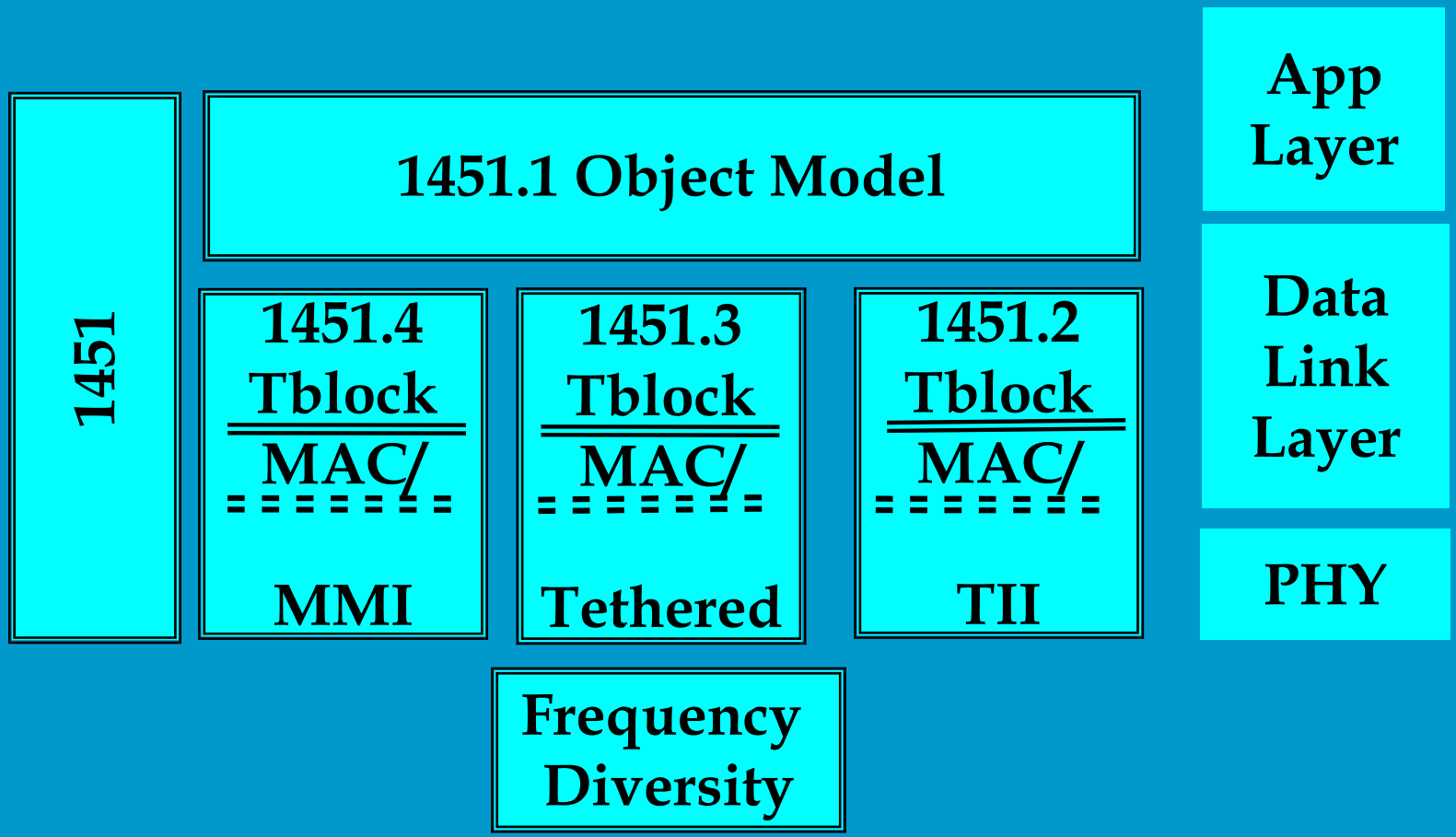
- P1451.3 Top 3 Requirements:
  - time synchronous acquisition from TBIMs to TBC via trigger event from TBC
  - minimal wire count
  - power TBIMs from bus



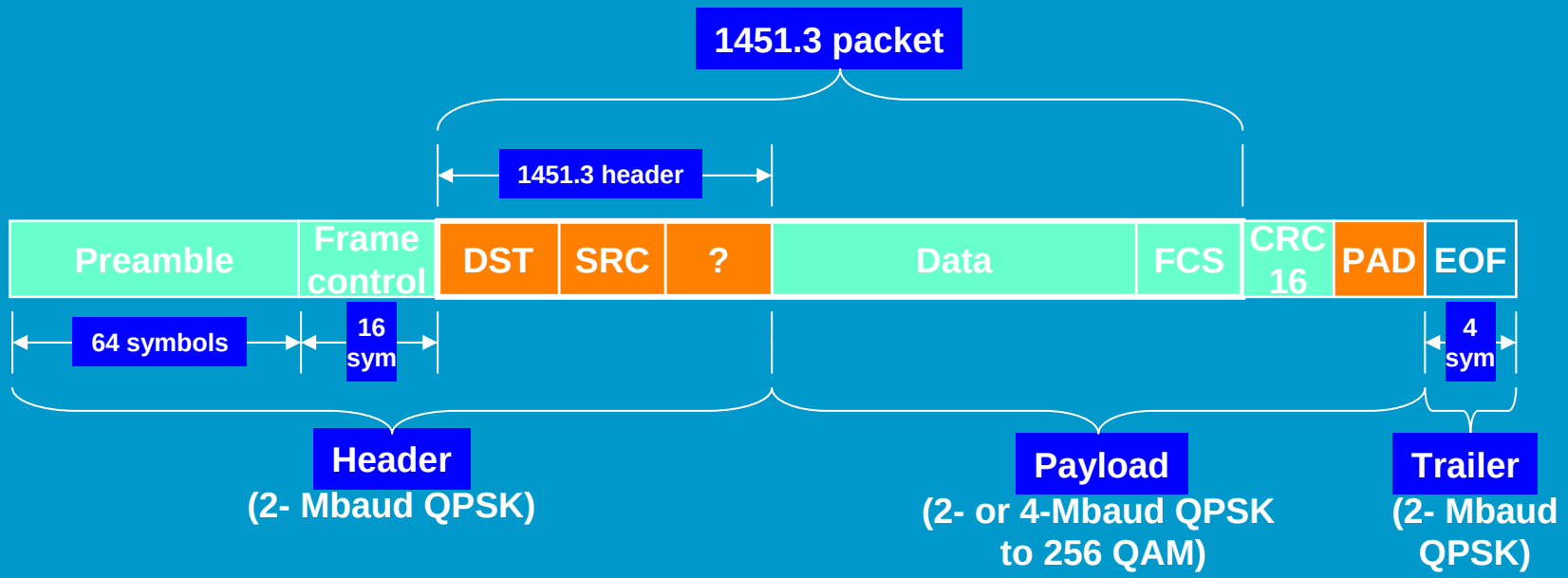
1451.3 Bus Architecture



IEEE 1451.3 Utilizes Frequency Diverse Communications for the PHY



Integration of Frequency Diversity and 1451.3



A More Extensible/Flexible TEDS

- Describing TEDS with XML provides flexibility for the future
- Virtual TEDS allows TEDS to be stored externally from TBIM
- Meta-TEDS will enable a common TBC to "host" varied-capability TBIMS

Transducer Bus Interface Module (TBIM) General Requirements

- Compliant with IEEE 1451.3
- Integrated transducer signal conditioning
  - Anti-aliasing filtering
  - Programmable gain, offset, A/D conversion
- Digital processing
  - Multi-rate digital filtering
  - Polynomial curve fit
    - » Compensation for environmental variables (usually temperature)
    - » Linearization
  - Engineering units conversion
- Plug & play
  - Transducer electronic data sheets (TEDS)
  - Common protocol stack
- Hot swap
- Two-wire transducer bus – power, communications, data

Synchronization is a Key Component of this Standard

- The enabling of time-stamped or time aligned data samples is a prime criterion of 1451.3.
- 1451.3 also provides commands for time correction of local crystals.
- A related standard IEEE 1588 - Precise Networked Synchronization