

IEEE Standard P1451.0

Defining the Core Features of Smart Sensors to Facilitate Broader Adoption

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Outline

- Goals and values of IEEE 1451
- Present situation
- Proposed “dot zero” standard
- Expected results
- Next Steps

Main goals for IEEE 1451

- Develop network independent and vendor independent transducer interfaces.
- Allow transducers to be replaced and/or moved with minimum effort.
- Eliminate error prone, manual system configuration steps.
- Support a general transducer data, control, timing, configuration and calibration model.
- Develop Transducer Electronic Data Sheets (TEDS) that remain with the transducer during normal operation.

Core Values of the IEEE 1451 Family

- Extensible Transducer Electronic Data Sheet (TEDS)
- General calibration/correction model for transducers
- Data models based on common standards such as IEEE floating point numbers
- Physical units representation based on SI units
- Control and operation models for different kinds of transducers
- Flexible correction engine concept
- All of the above must be common in order to have a basis for a common TEDS

Present Situation

- The IEEE 1451 family of standards has established several valuable basic principles of smart transducers, the most important of which is the TEDS
- Different physical interfaces are needed by different applications, and more will be needed in the future.
- There is a growing desire for commonality and interoperability among the members of the IEEE 1451 family
- IEEE P1451.0 was proposed to:
 - Encourage compatibility across the IEEE 1451 family
 - Make it easy to develop IEEE 1451 standards using new physical layers

IEEE P1451.0 Status

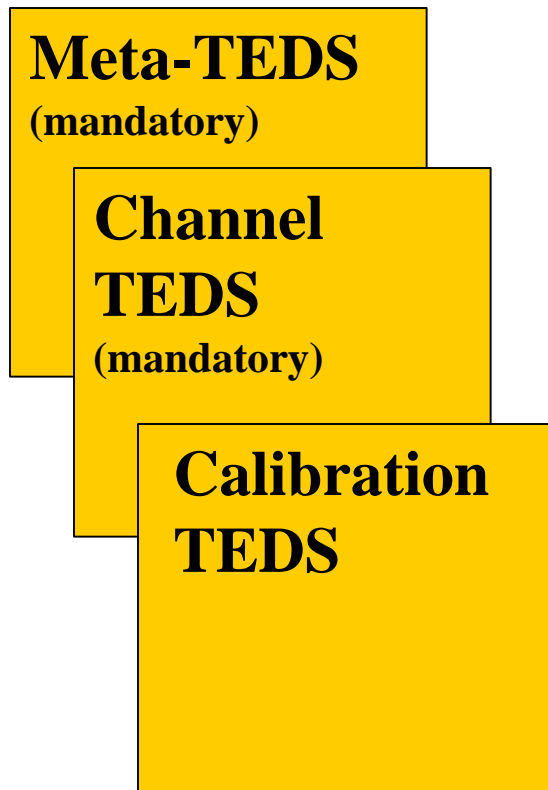
- Study Group appointed October, 2002
 - Included all past and present Working Group chairs
- Study Group accomplishments:
 - Definition and Vision for IEEE P1451.0
 - Proposed IEEE 1451 Family Interoperability Guidelines
 - Block diagrams illustrating the architecture concept
 - List of Items for consideration for standardization
- Project Authorization Request (PAR) for IEEE P1451.0 approved by IEEE on March 20, 2003

IEEE P1451.0 Definition/Vision

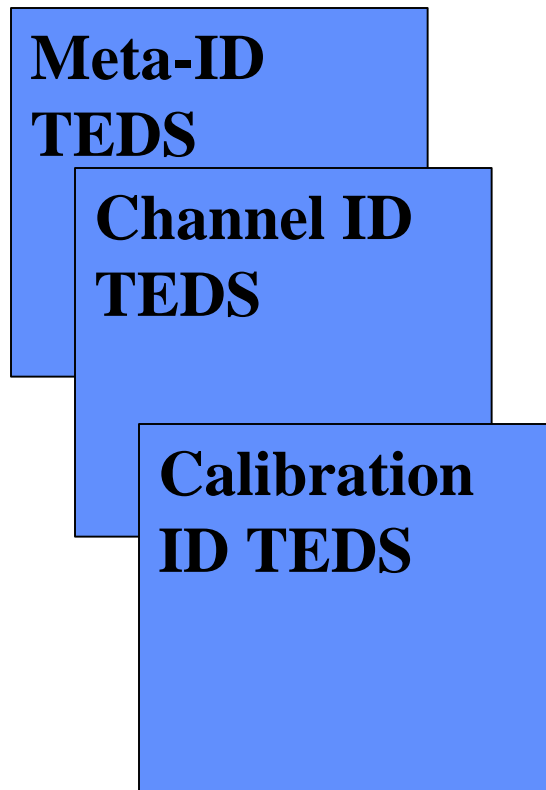
“IEEE P1451.0 is a physical-layer independent NCAP-to-transducer module interface that includes the basic command set and communications protocol. All that is necessary to implement a new variety of IEEE P1451 is to define the physical layer, including the physical layer TEDS, plus any specialized functions or commands necessary to support the selected physical layer.”

It's the TEDS...!

Machine readable



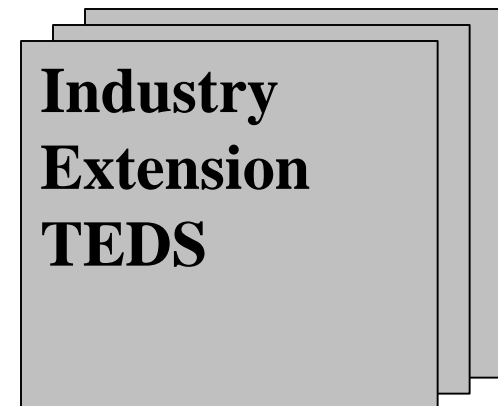
Human readable



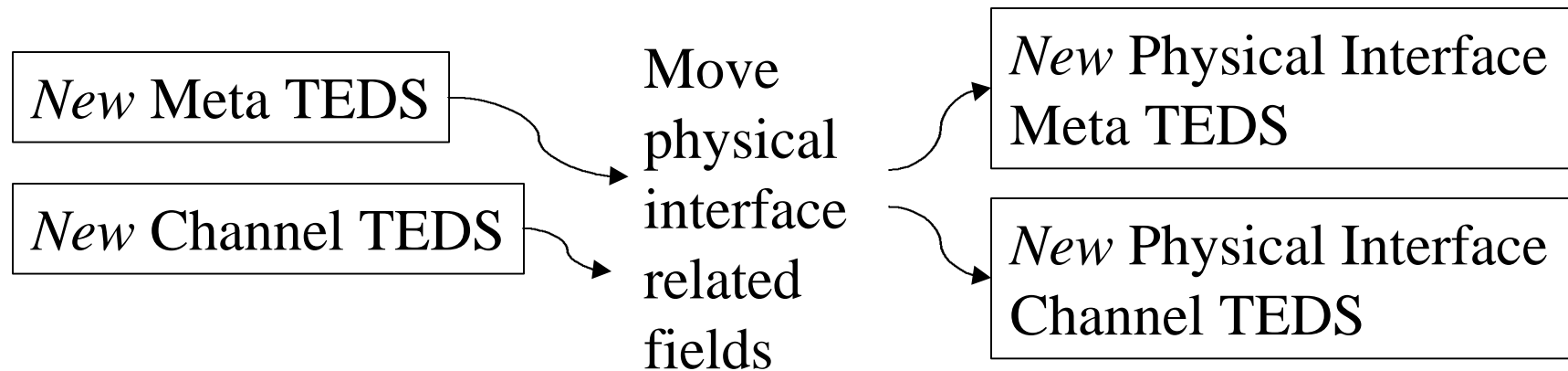
Application specific



Future extensions



Partition the TEDS



Meta-ID TEDS

Channel-ID TEDS

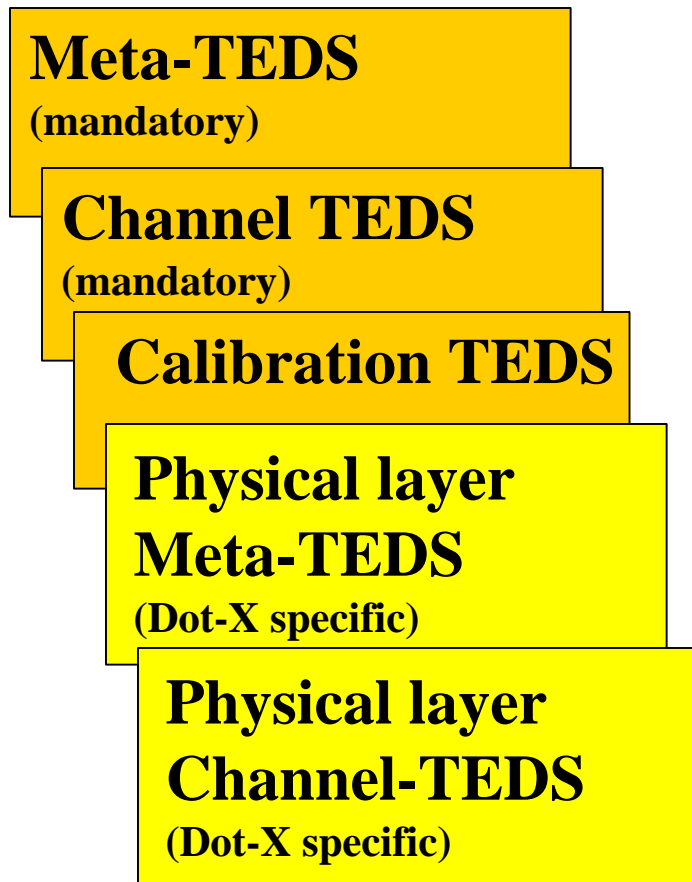
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Other TEDS blocks can remain the same.

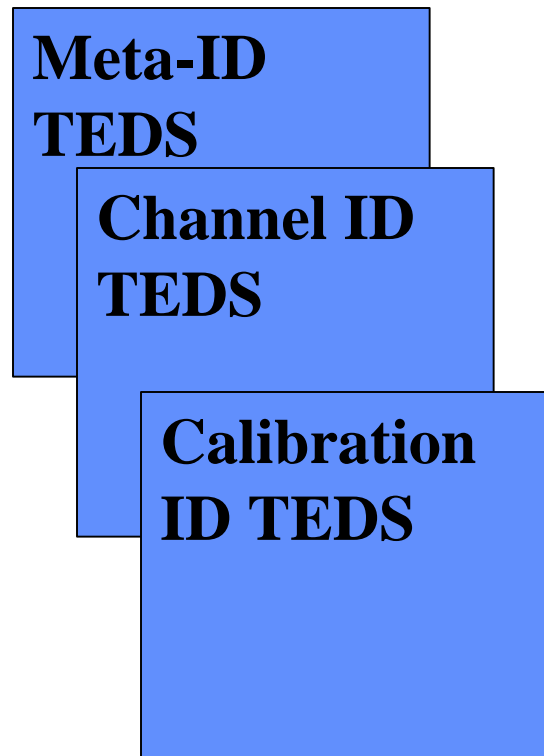
Supports use of different physical layers.

Proposed IEEE P1451.0 TEDS Architecture

Machine readable



Human readable



Application specific



Future extensions



Everything not "Dot-X specific" is defined in IEEE P1451.0

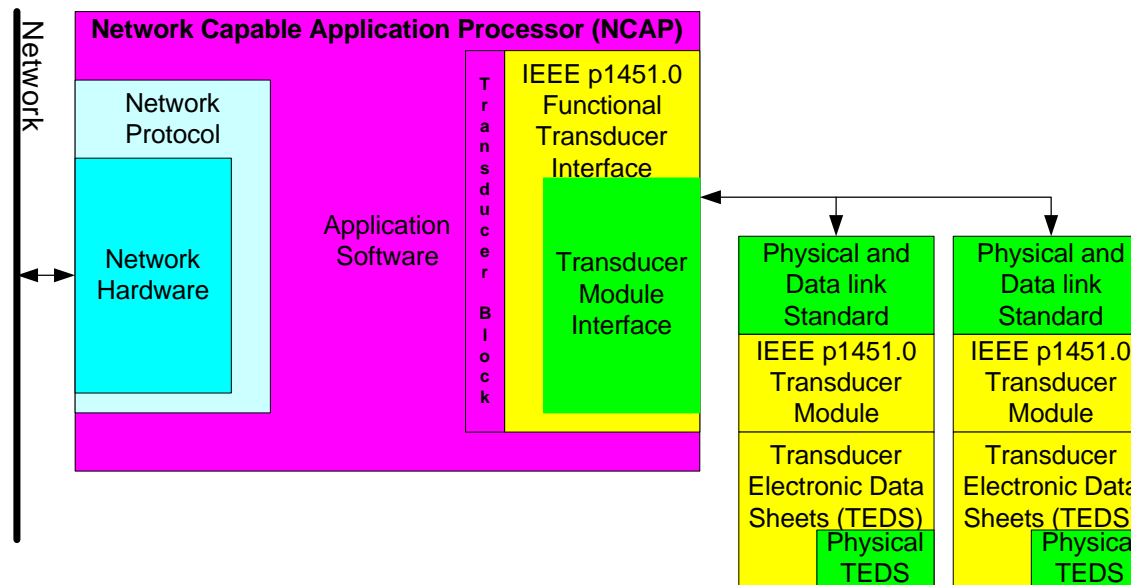
IEEE 1451 Family Guidelines

- IEEE 1451 core values must be met
 - Each standard must define a mechanism for providing all data, including the core TEDS to be defined in IEEE P1451.0, necessary to meet the core values
- Interfaces are defined, not modules
 - Modules may support multiple interfaces
- Partitioning is invisible beyond the immediate interface
 - A module or network device should not have to know or care what interfaces are implemented past the immediate one
- Hot swaps must be allowed and passed on
 - Each standard must support a way to simulate the “hot swap” of a transducer and force the network-side device to accept the updated TEDS

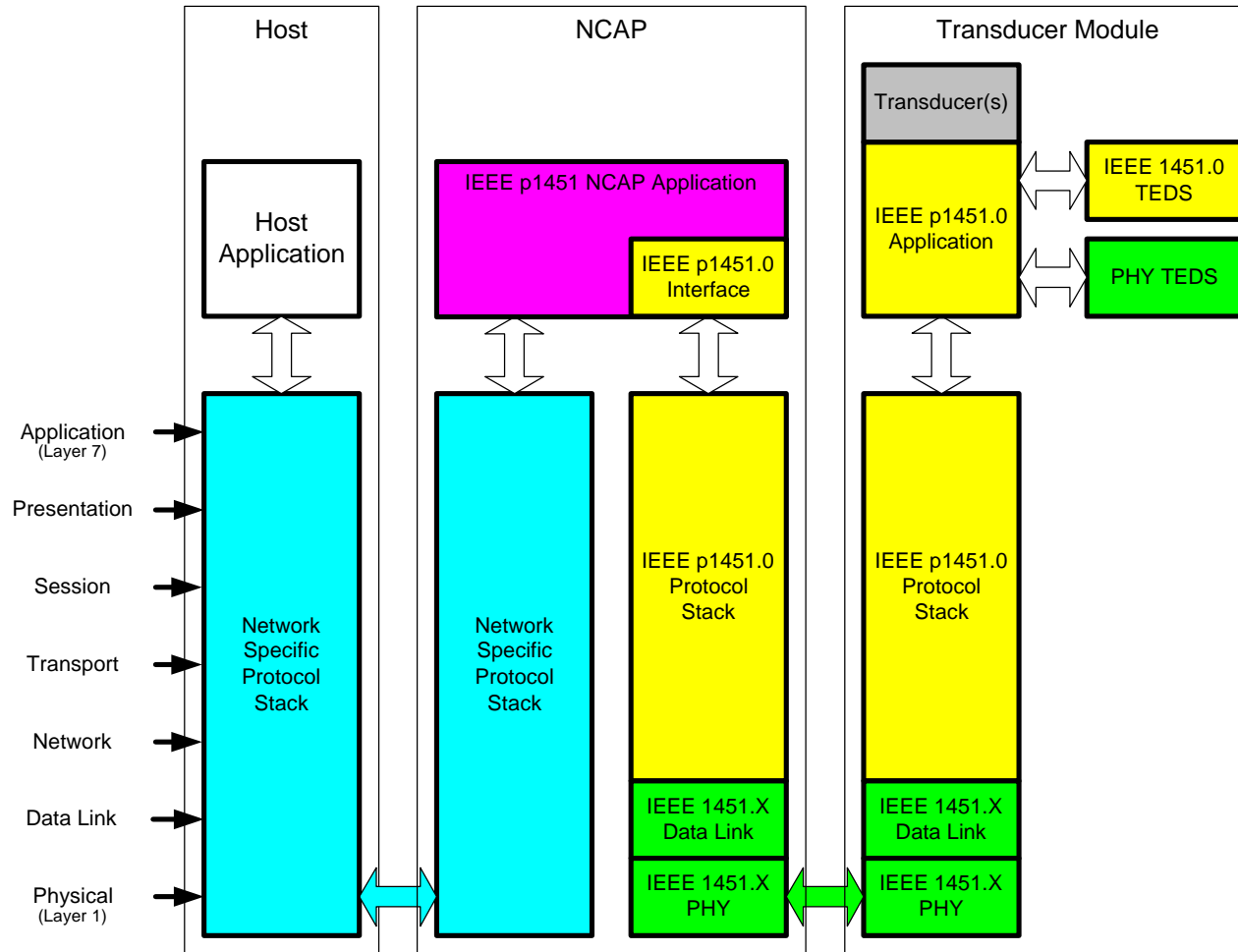
IEEE P1451.0 Block Diagram

Legend

- Optional Network Standards (Not 1451)
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- IEEE 1451.X NCAP (May include IEEE 1451.1 or other software interface)
- IEEE p1451.0 Functional Standard
- IEEE 1451.2, IEEE p1451.3, IEEE p1451.4, IEEE p1451.5 or etc.



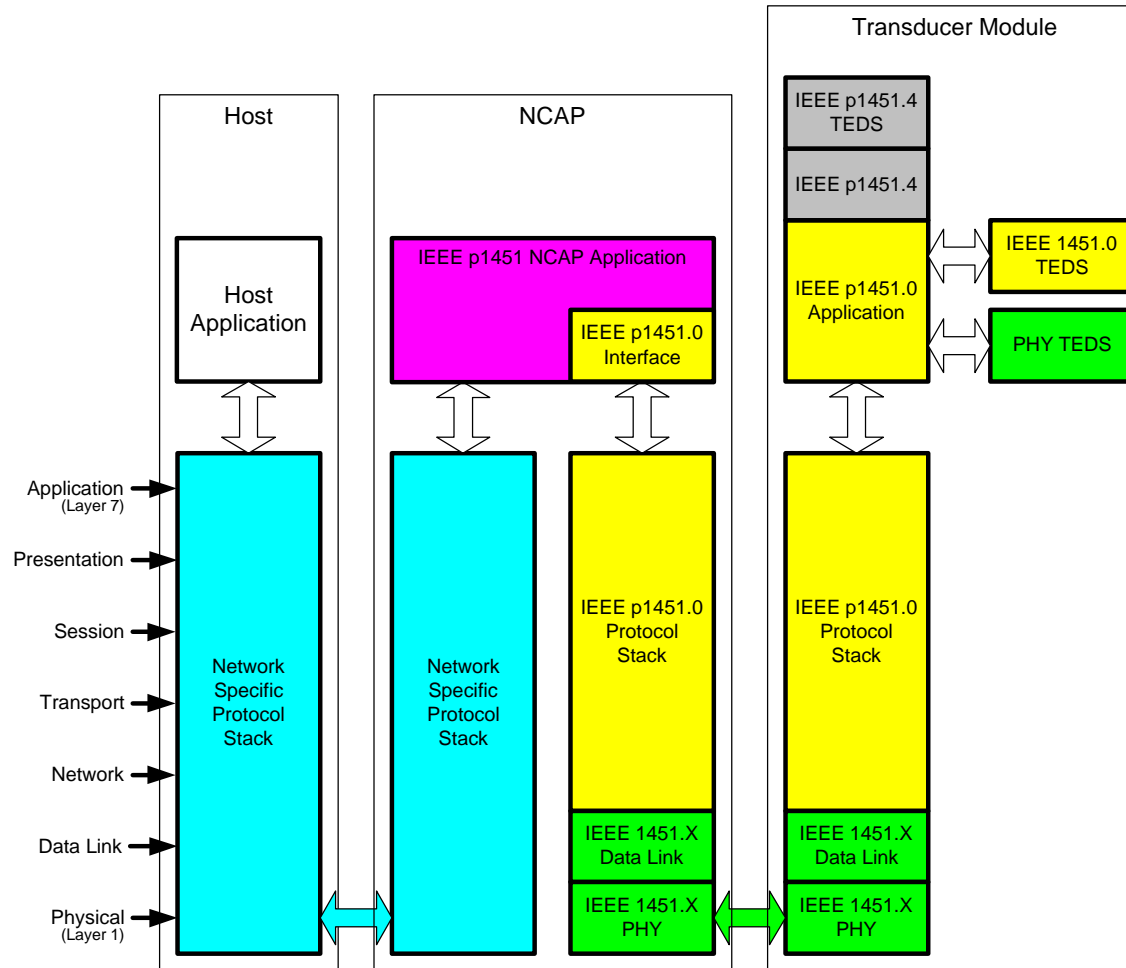
IEEE P1451.0 Architecture



What About IEEE P1451.4?

- The compact TEDS proposed for IEEE P1451.4 cannot include a complete IEEE P1451.0 TEDS, although a template file can provide most of the content
- Also, since the data for a P1451.4 device is analog, a lot of the TEDS content is not applicable
- **BUT**, the module that the P1451.4 device connects to can provide the translation to the full P1451.0 content in addition to the conversion between digital and analog
- The important thing is that we coordinate such things as units, data representation, correction engine, etc. for true family compatibility
- Properly done, other network-side devices need not know if the transducer is P1451.4 or another flavor

IEEE P1451.0 with IEEE P1451.4



Benefits of IEEE P1451.0

- Reduction in duplication of effort
- Commonality and compatibility cross the entire IEEE 1451 family of standards
- Common network-side view of all devices
- Ease of adding additional physical media **when** they are needed in the future
- IEEE P1451.0 standardizes the **message**, not the medium

What's Next?

- IEEE Standard P1451.0 Working Group has been formed
 - Robert Johnson, Chair
 - Lee Eccles, Editor
- Defining major issues and forming subgroups
- Coordinating with other IEEE P1451.X working groups
- Setting up mailing list and Web site
- See <http://grouper.ieee.org/groups/1451/0/> or send email to p1451.0@ieee.org for more information

Questions/Comments?