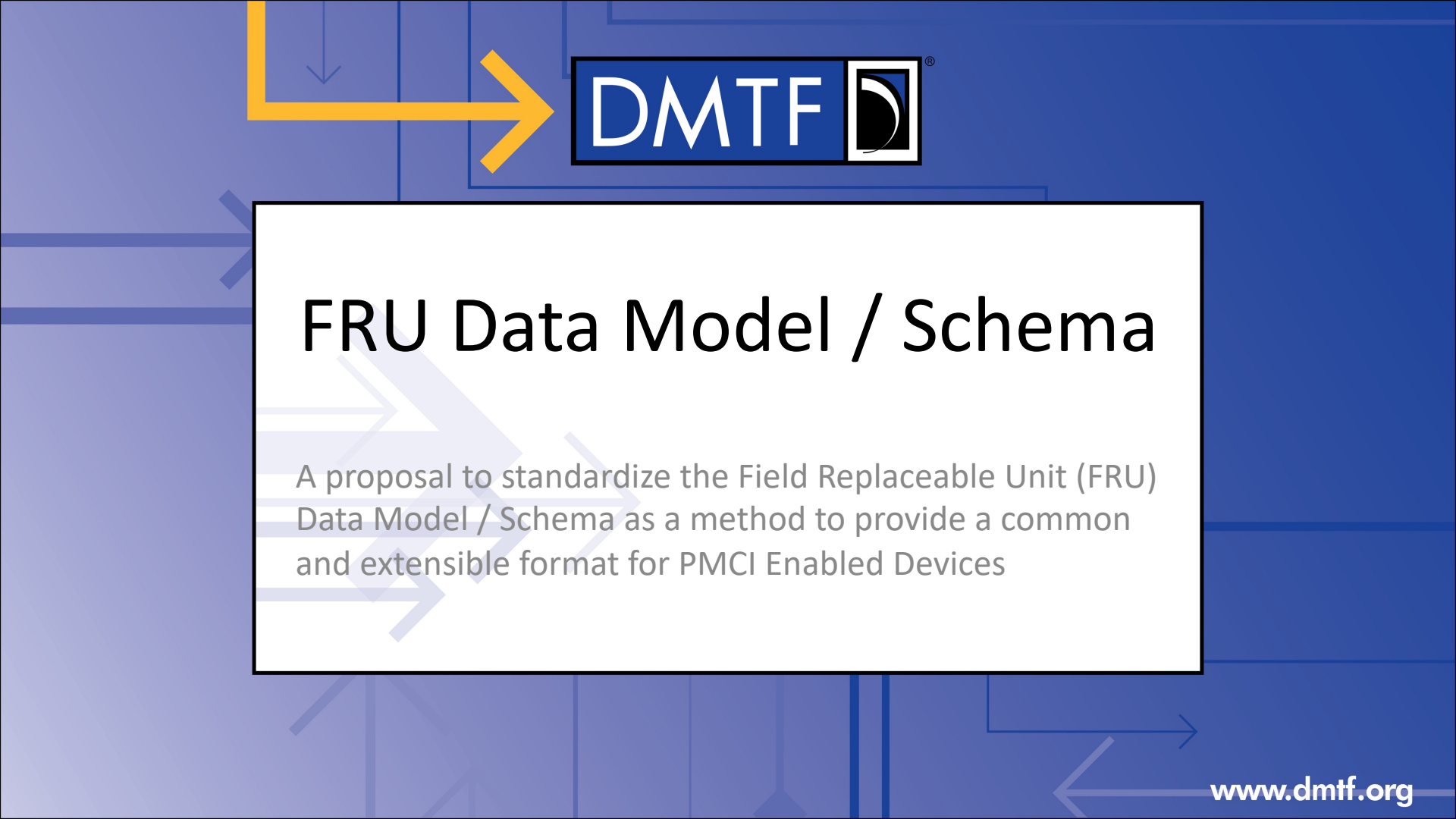

FRU Data Model / Schema

A proposal to standardize the Field Replaceable Unit (FRU) Data Model / Schema as a method to provide a common and extensible format for PMCI Enabled Devices

Disclaimer

- The information in this presentation represents a snapshot of work in progress within the DMTF.
- This information is subject to change without notice. The standard specifications remain the normative reference for all information.
- This information is a summary of the information that will appear in the specifications. See the specifications for further details.
- For additional information, see the DMTF website.
- Feedback may be submitted via the DMTF Feedback and Technology Submission portal. Click (or go to) www.dmtf.org/standards/feedback for details.

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Historical View of Field Replaceable Unit (FRU)

- IPMI defined a common format based on the Atmel EEPROM in 1998
  - Platform Management FRU Information Storage Definition (currently revision 1.3)
- This common data storage / access format is adopted across the industry for option (add-in) adapter inventory.
  - Heavy adoption of IPMI in Linux based environments pushed the standard
  - Most DMTF PMCI WG adapters support the standard
  - OCP 3.0 NIC and NVMe consortium have adopted the standard
  - The entire Demand / Supply chain is based on IPMI but is difficult to extend
  - Manufacturing processes exist to write the data to the physical media – Well Understood Process.
- Like many standards / conventions in the industry, this standard's features encouraged quick adoption:
  - Common Access Method, based on i2C, with a well-defined simple access method
  - Data objects were common things such as Product Name, Number, Serial Number
  - Multi-Record with OEM record definition allowed for innovation and extensions to the specification
  - Low-cost data storage (hardware)

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Reasons to push a common industry standard

- With multiple industry standard (specification) consortiums working in diverse technologies and all seeking a method to provide device data to a consumer, there is a need for the industry to consolidate on a modern method that may last another 10 – 20 years.
- Innovation / OEM differentiation added complexity and divergence
  - Different industry standards bodies implementing similar data features in different formats
  - Many industry standards added multi-records in a variety of formats
    - Power Capabilities, NVMe Parameters, Vendor Specific Data have extended the purpose.
  - While the raw data access method (with a simple data integrity check) is well known, the parsing of the data diverged, which put a heavy burden on the data consumer, typically the Baseboard Management Controller (BMC)
  - Tool chain typically takes text/JSON data, translates to binary, stores it in EEPROM, only to reverse the process to retrieve the data into a usable format.
- Leverage modern data formats like JSON which are easier to extend and consume
- Move away from the IPMI limitations such as 6-bit ASCII & 255-byte structure limits
- Field updates with IPMI format are challenging
- IPMI specs are no longer maintained and will not longer publish any new updates

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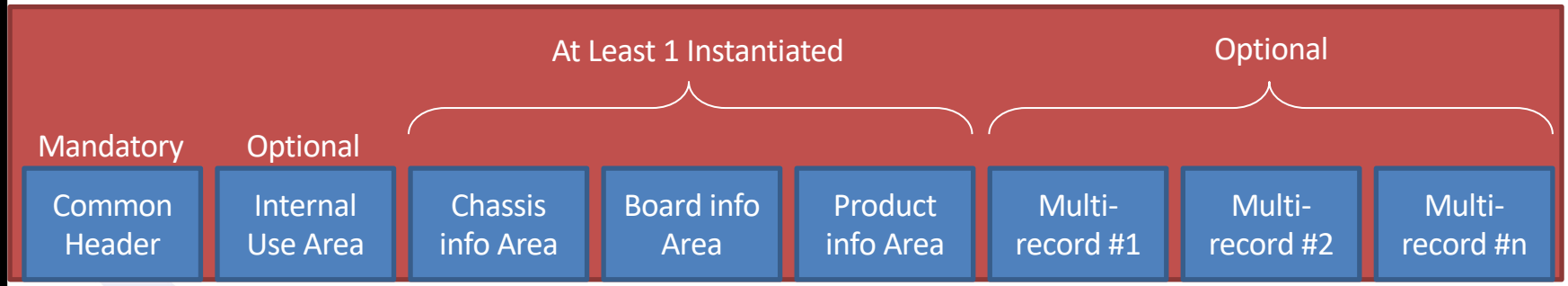
IPMI Storage FRU Layout, Revision 1.3



Section / Area	Estimated Max Size	Comments
Common Header	8	All IPMI Storage FRU shall implement the Common Header
Internal Use Area	Not Specified	Vendor Specific, no defined format, Would not recommend exceeding 1024
Chassis Info Area	133	Typically, would describe a Chassis / Rack that is NOT an optional adapter. Could be larger if custom fields
Board Info Area	328	Rarely this large but this is possible based on variable length fields. This is designated typically for a Baseboard type FRU
Product Info Area	328	Rarely this large. This is designated for an Add-In Option Adapter or Customer Facing Marketing Information
Multi-Record	255	The multi-records are chained together and are only limited by the physical EEPROM size. Most common usage of Multi-Record is Vendor OEM Specific, and these records are defined outside of the specification.

Notes: The Board Info Area and Product Info Area have duplicate fields if both are populated. The purpose of these fields, however, is different and today may no longer be meaningful

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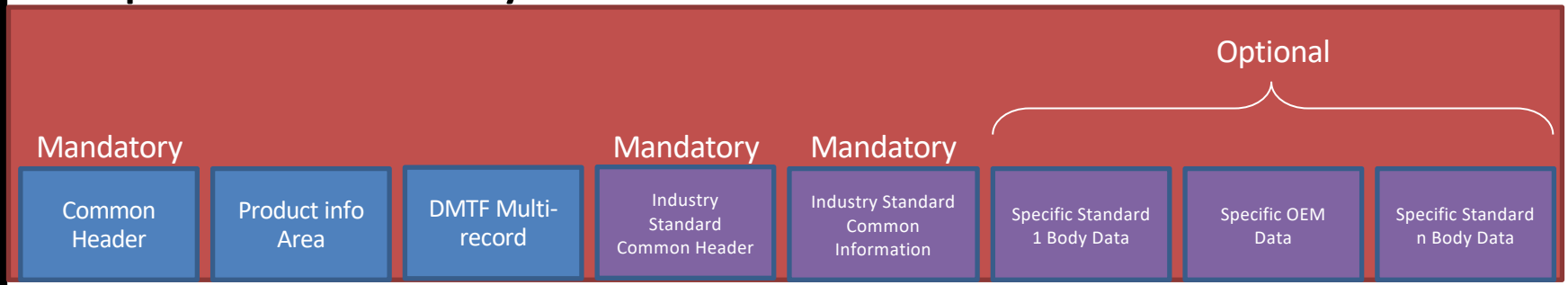
Proposed Industry Standard Common FRU Format



Section / Area	Estimated Max Size	Comments
Common Header	8	Industry Standard Common FRU shall implement the IPMI Common Header for backward compatibility
Product Info Area	328	Industry Standard Common FRU shall implement the IPMI Common Header for backward compatibility. This is designated for an Add-In Option Adapter or Customer Facing Marketing Information. Small duplication with Common Information
Multi-Record	32	This is a DMTF defined Multi-Record that is the offset (pointer) to the Industry Standard Common Header
Industry Standard Common Header	Var	New Record to assist the consumer, typically the BMC, with identifying standards body data present in the EEPROM (or other device) as well as common information
Industry Standard Common Information	Var	This will the be place to hold common information such as manufacturer, Manufacturer Part Number, Vendor Part Number, Manufacturer Product Name, Vendor Product Name, Serial Number, Build Date, and other data elements to be determined / donated by DMTF / PCIe / CXL Industry Partners
Specific Standard Body Data	Var	This will be the place to hold a specific Standards (Consortium) Body content which would be unique. This would be data that is not considered to be even slightly common to all Industry Standards. Example would be Power Consumption. This is common, not unique. PCIe Lanes / Bifurcation could be common but may be specific. Need Industry Input to help

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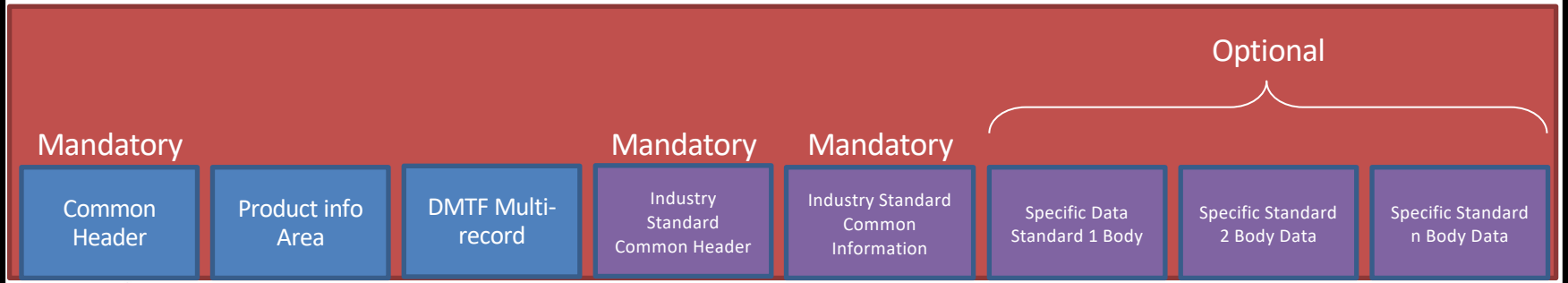
Goals



- Recommendation is baseline backward compatibility for existing BMC / implementations with a plan for a transition to the purple boxes. Eliminate the blue boxes but have a unique 8 – 16-byte UDID at offset 0
- All new Purple boxes shall be easily extensible.
- Industry Standard Common Header will need to have static Standard Body Data types so a BMC can quickly locate the offset.
- Industry Standard Common Information will have Defined Tags while allowing for Vendor Defined or Standard Body tags and associated data. Do NOT want to pollute this space but also want to strongly encourage Common Data Usage to avoid duplication.
- Specific Standard Body Data is defined by the Standard Body but in the format proposed by the DMTF for this specification
- Easily extract the data with minimal I/O.
- Ability to store multiple data formats such as JSON, Binary, Text, etc.
- Ability to support field update of the FRU image

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Example of Industry Standard Common Header

Record ID	Owner ID (16 bytes UTF-8)	Offset	Length
0x0001	1AB4	0x4000	0x2000
0x0002	PCIe _____	0x6000	0x1000
0x0003	NVMe	0x8000	0x1400
0x0004	CXL	0xA000	0xnnnn
0x0005	OEM ID	0xC000	0xnnnn
0x000n	nnnn	0xnnnnn	0xnnnn

Recommendations:

- Recommend a layout that allows each section to expand without having to rewrite the entire EEPROM
- Recommend that groups push to have common fields, keeping each standards body data unique / technology specific
- The actual size will be much smaller and could fit in a 4Kb Serial EEPROM
- Plan is to eventually remove the IPMI Legacy, leaving only the new format.
- Goal is unique owner ID that is easy to parse to locate data.
- Goal is to allow independent innovation by allowing unique self-assignment for owner ID (e.g., IANA or PCIe Vendor).

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Example of Industry Standard Common Information

Data Size	Identifier Type	Identifier ENUM	Identifier STRING	Data Type ENUM	Data
18	B	1	“Manufacturer”	1	“Intel Corporation”
10	B	2	”Module Number”	1	“INTC12345”
20	B	3	“Product Name	1	“New Amazing Product”
1	B	55	“MCOT”	3	95

Data Size	Identifier Type	Identifier ENUM	Identifier STRING	Data Type ENUM	Data
18	E	1	0x00	1	“Intel Corporation”
10	E	2	0x00	1	“INTC12345”
20	E	3	0x00	1	“New Amazing Product”
1	E	55	0x00	3	95

Note:

- This is just an example to stimulate some conversation.
- Identifier Type: (E)num, (S)tring, (B)oth present
  - ENUM: {1=Manufacturer, 2=Product Model Number, 3=Product Name, 4=Vendor Model Number, 5=Vendor Product Name}
- Data Types: String (Null Terminated) and Numeric (Binary) type
  - ENUM: {1 = String, 2=UINT, 3=SINT, 4=REAL}
- As others contribute to the “Industry Standard Common Information”, the “field format / structure” will evolve and be comprehensive. Simplicity, however, remains a primary goal of this project.

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Example 2 of Industry Standard Common Information


```
{
  "@odata.type": "#Assembly.v1_3_0.Assembly",
  "Id": "Assembly",
  "Name": "System-related Assembly data",
  "Assemblies": [
    {
      "@odata.id": "/redfish/v1/Chassis/1/Assembly#/Assemblies/0",
      "MemberId": "0",
      "Name": "System Board",
      "Description": "PCA System Board",
      "PhysicalContext": "SystemBoard",
      "Model": "345TTT",
      "PartNumber": "923943",
      "SparePartNumber": "55-434",
      "SKU": "55ZZATR",
      "SerialNumber": "345394834",
      "Vendor": "Contoso",
      "ProductionDate": "2017-04-01T14:55:33+03:00",
      "Producer": "Contoso Supply Co.",
      "Version": "1.44B",
      "EngineeringChangeLevel": "9",
      "BinaryDataURI": "/dumpster/434",
      "Oem": {
        "Contoso": {
          "Region": "C",
          "Packaging": "Retail"
        }
      }
    }
  ]
}
```


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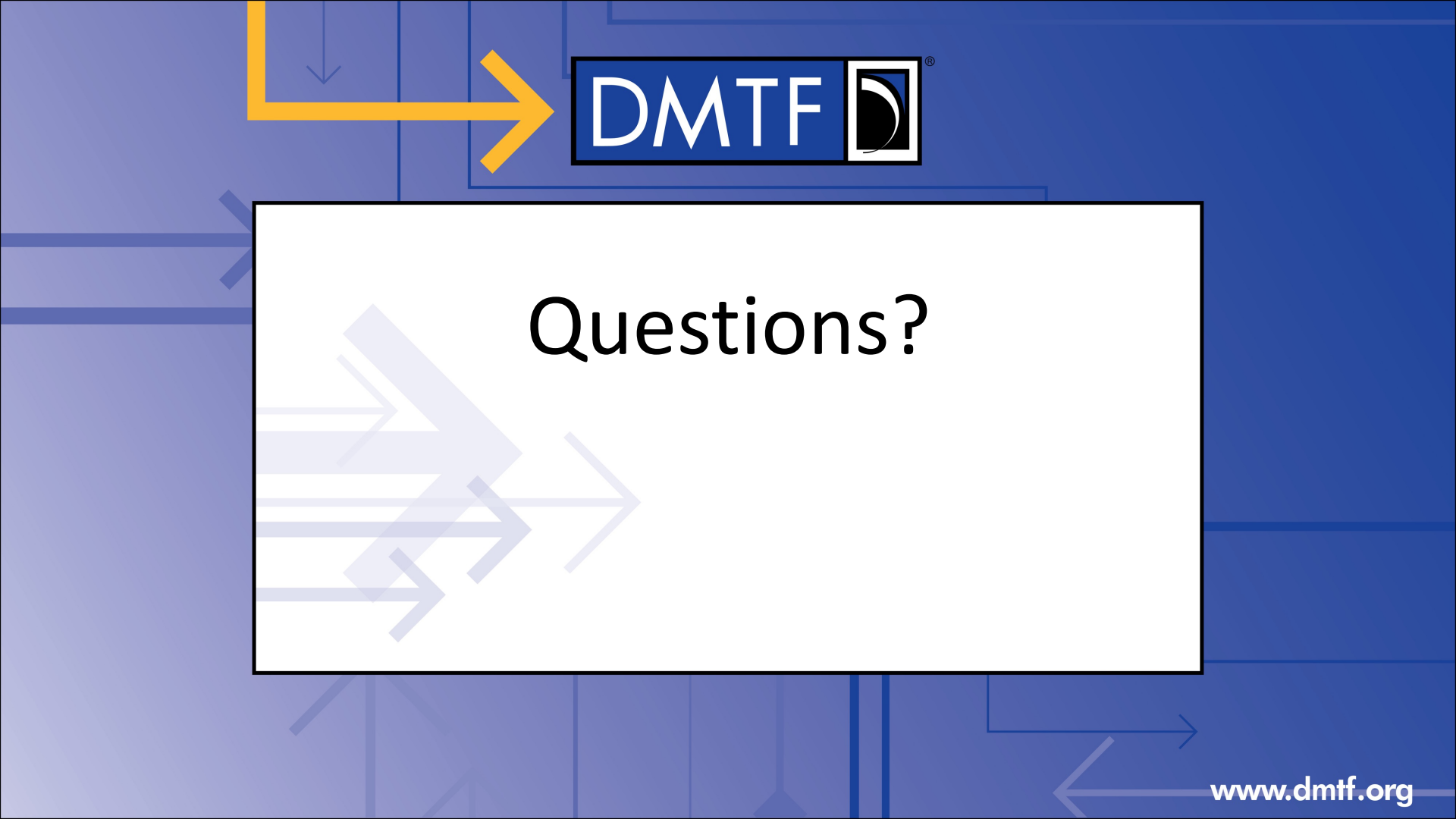
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