SciDataCon 2022 – 22 June 2022

CODATA WORLD DATA SYSTEM

SciDataCon

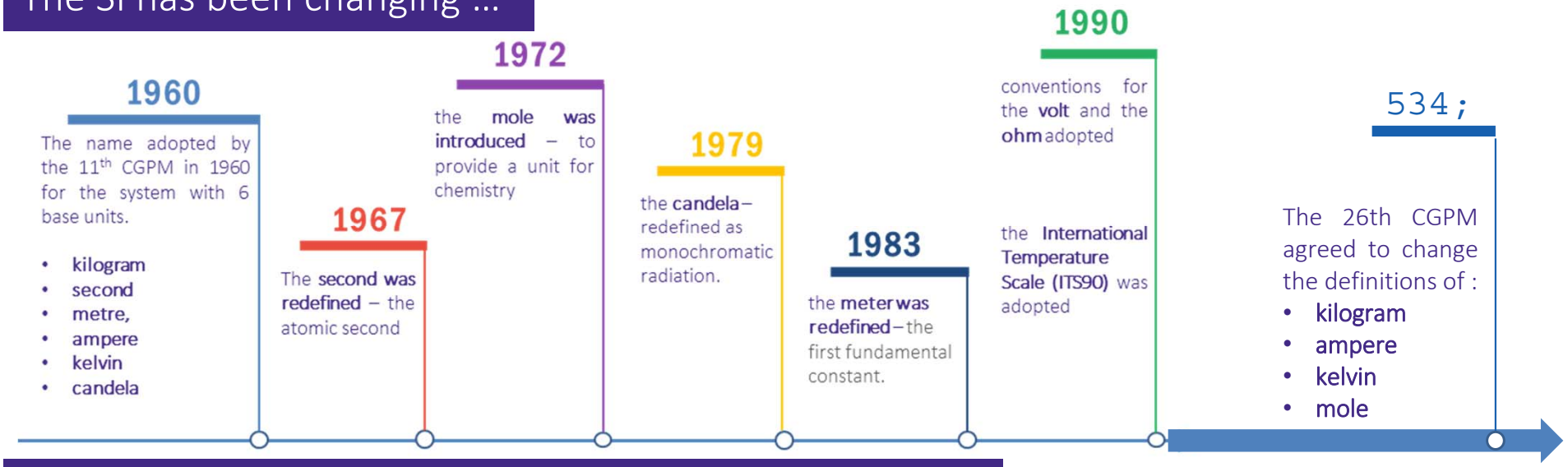
Developments Towards Interoperable Metrology

the work of the BIPM to develop new digital service

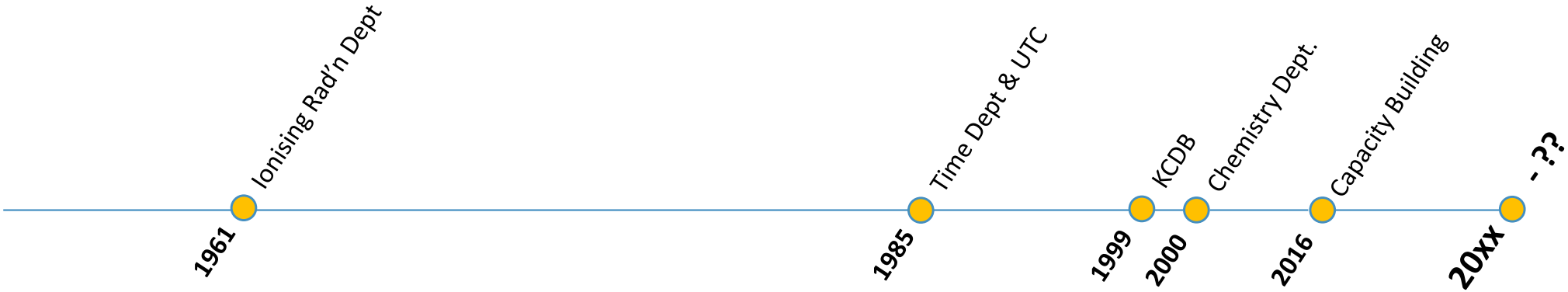
Bureau International des Poids et Mesures

Dr Martin MILTON
BIPM

The SI has been changing …



and the BIPM Work Programme has been changing …



The 27th meeting of the CGPM

Resolution B – "On the global digital transformation and International System of Units"

Encourages

the CIPM to continue its outreach and engagement initiatives to ensure that the Metre Convention naturally extends its role as the globally accepted anchor of trust for metrology into the digital era,

the CIPM to undertake the development and promotion of an SI Digital Framework, that will include the following features:

- a globally accepted digital representation of the SI, compatible with, and useable within, digital data exchange standards and protocols, whilst maintaining compatibility with existing non-digital solutions,
- facilitating use of digital certificates in the existing robust infrastructure for the world-wide recognition and acceptance of calibration and measurement capabilities,
- the adoption of the FAIR principles (Findable, Accessible, Interoperable, and Reusable) for digital metrological data and metadata, ensuring that other communities recognize the critical importance of metrological traceability for measurement data, the latter being an established requisite for building trust.

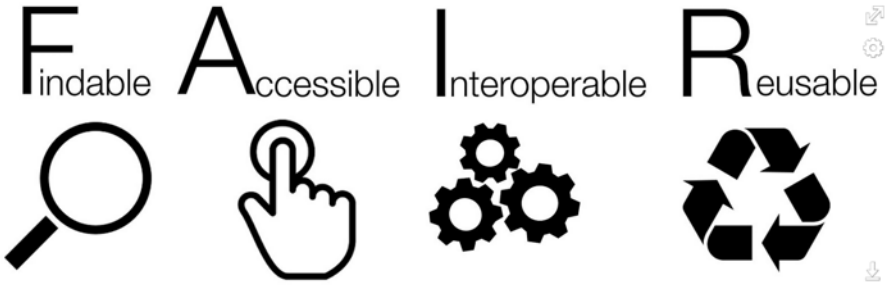
CGPM

What is FAIR data ?

- *Statement from the G20 leaders at the 2016 summit in Hangzhou.*

"We support effort to promote voluntary knowledge diffusion and technology transfer on mutually agreed terms and conditions. Consistent with this approach, we support appropriate efforts to promote open science and facilitate appropriate access to publicly funded research results on findable, accessible, interoperable and reusable (FAIR) principles".

What is FAIR data ?



- **Data are Findable** when they are
  - **described by sufficiently rich metadata and registered or indexed in a searchable resource**.
- **Accessible data objects** can be obtained
  - **through a well-defined and universally implementable protocol**.
  - 'The 'A' in FAIR does not necessarily mean 'Open' or 'Free'.
- **Interoperable data and metadata** are those that
  - **use a formal, accessible, shared, and broadly-applicable language**.
- For **data to be Reusable**, they need
  - **rich metadata and documentation that meet relevant community standards.**

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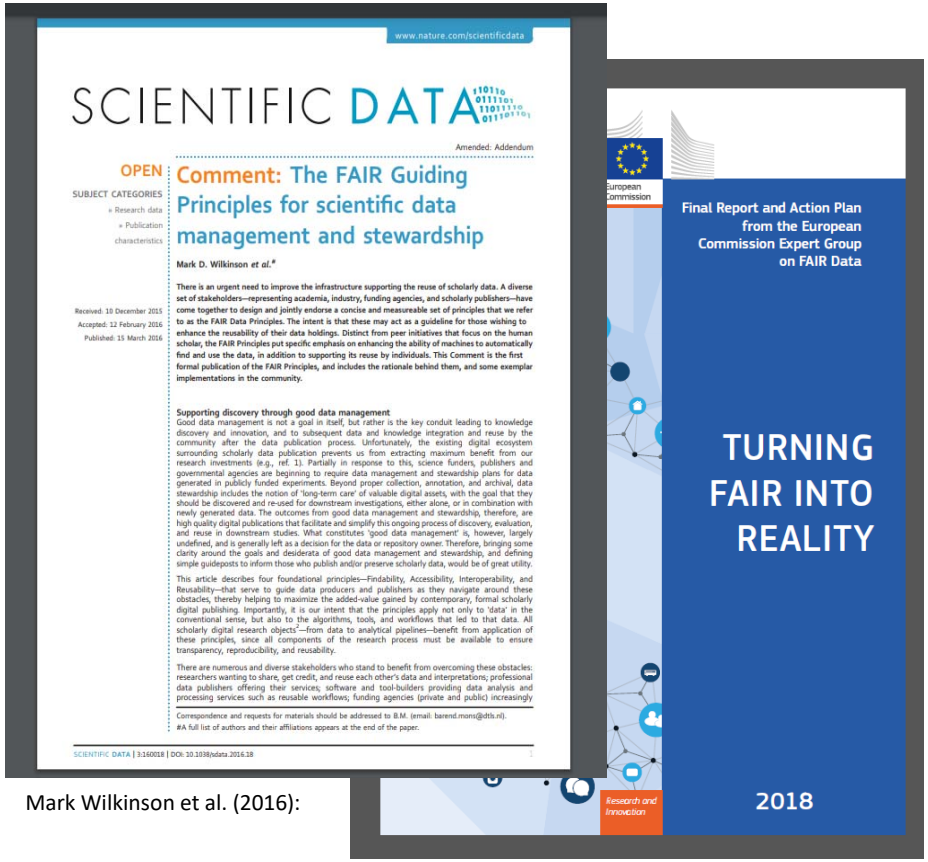


Mark Wilkinson et al. (2016):

Degrees of difficulty in FAIR
(size reflects difficulty)

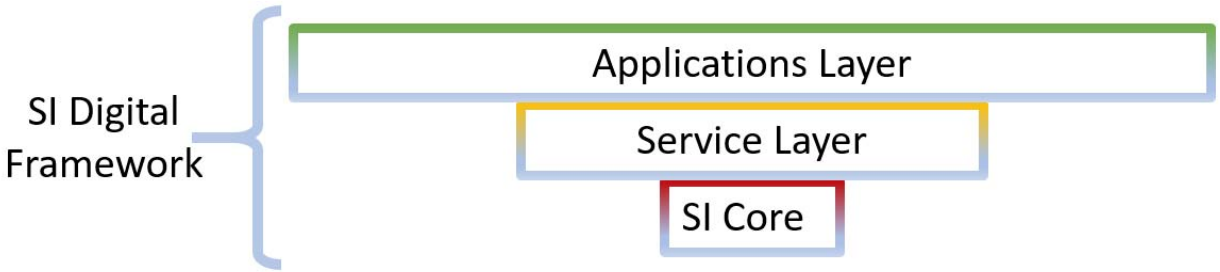
FAIR

'*Turning FAIR into reality: Final Report and Action Plan from the European Commission Expert Group on FAIR Data*', 2018,

the SI Digital Framework

Being developed by the CIPM with three layers:

1. **SI core representation**, defined by CIPM: Metadata models and exchange format implementations for basic data elements comprising values, units and uncertainty of a quantity based on the BIPM SI Brochure.
2. **Services**, implemented by the NMIs, BIPM and related organizations: Open data formats and software tools and services that build upon the SI core representation. Such services enable data to be ready for analysis, improve data quality and reliability, facilitate life-cycle analysis, communicate that data is fit for purpose, and improve data transparency.
3. **Applications**, developed and deployed in the broader metrology community and in research disciplines that rely upon the SI: Tools and services can be utilized in domain-specific applications, including sophisticated analysis and AI/ML methods, and, through layering on the SI core representation, assure reliability and traceability.



"Transforming the International System of Units for a Digital World"
Approved Oct 2020 - CIPM/109-17

How can the work of the BIPM laboratories and databases lead to Findable and Accessible data?

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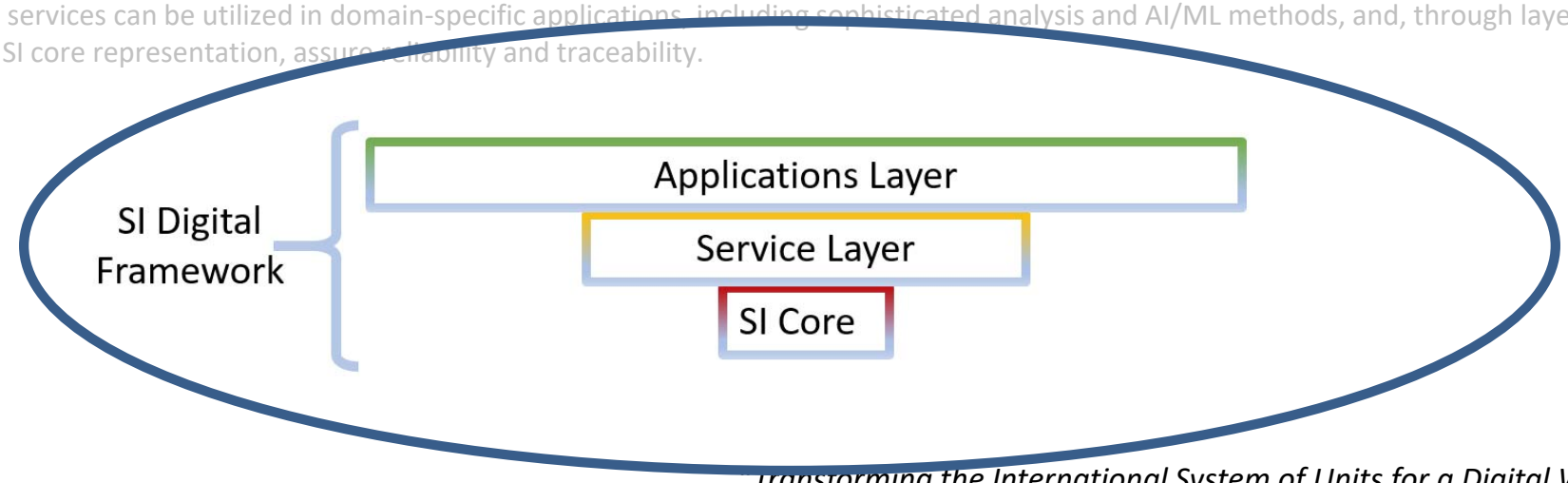

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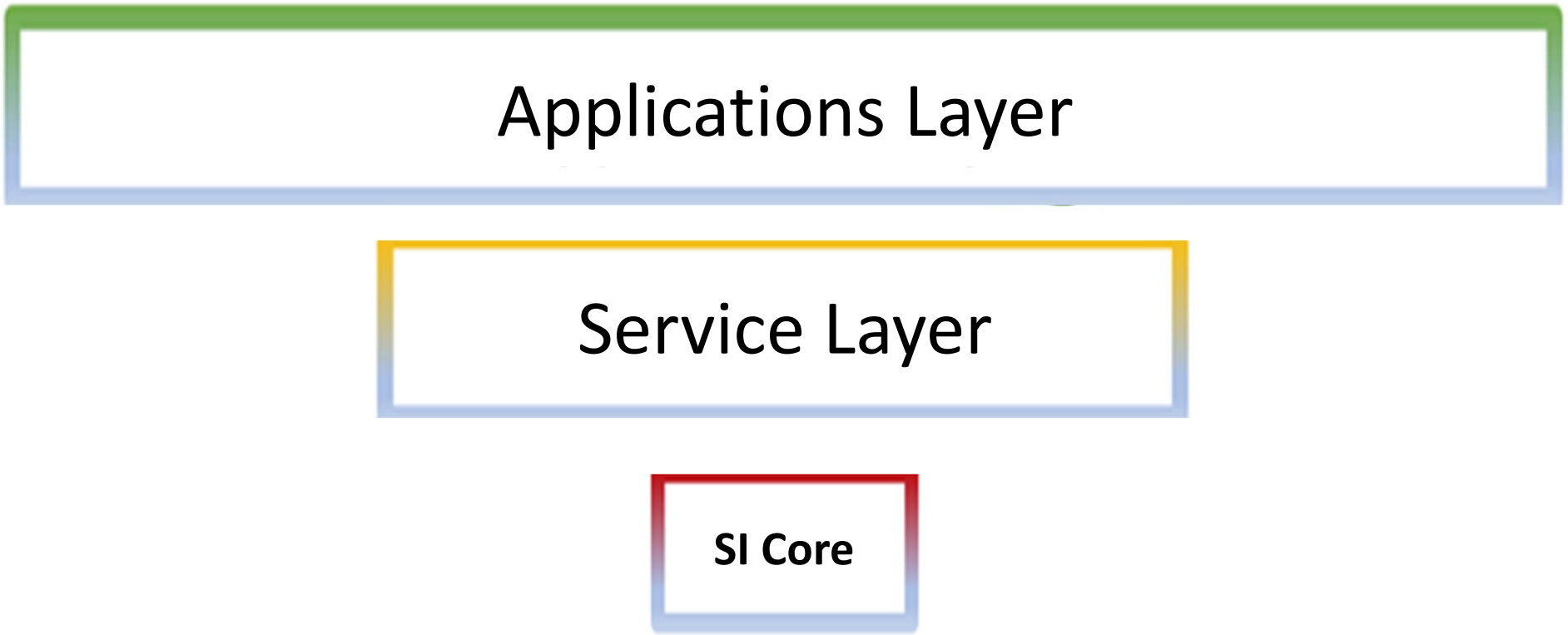
The Data Plane: Findable and Accessible



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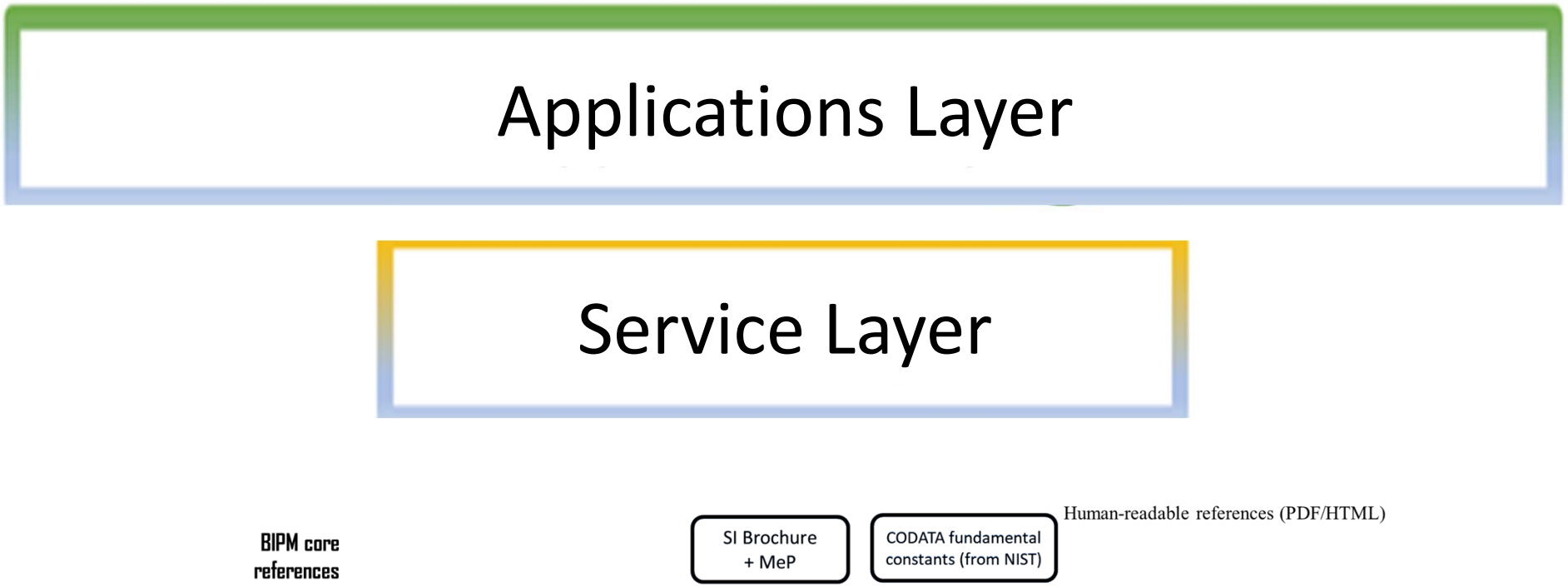
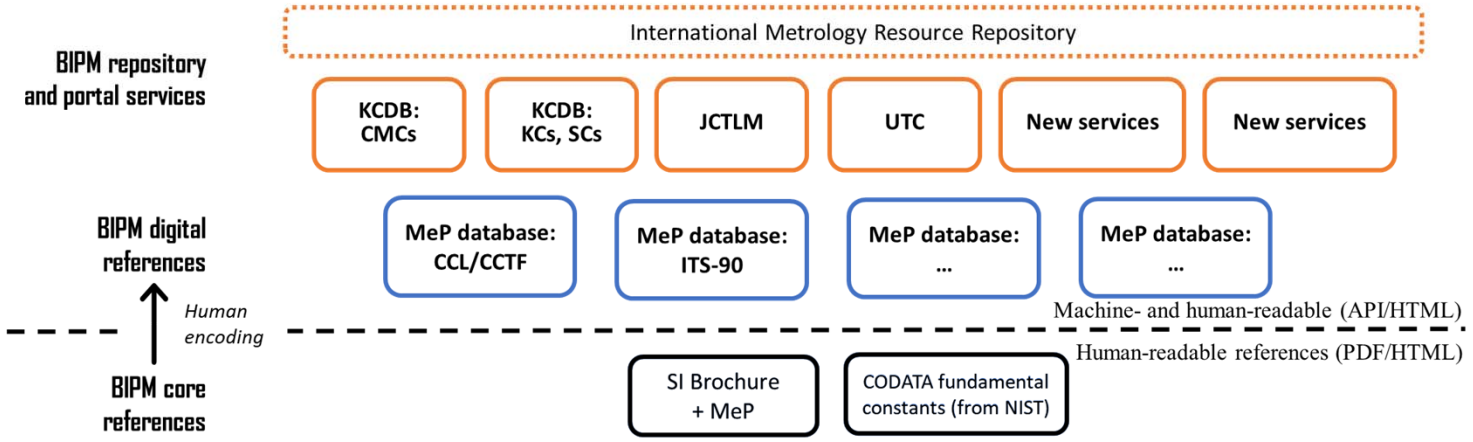


MeP = *Mise en Pratique* = {Practical realization}

The Data Plane: Findable and Accessible

Applications Layer



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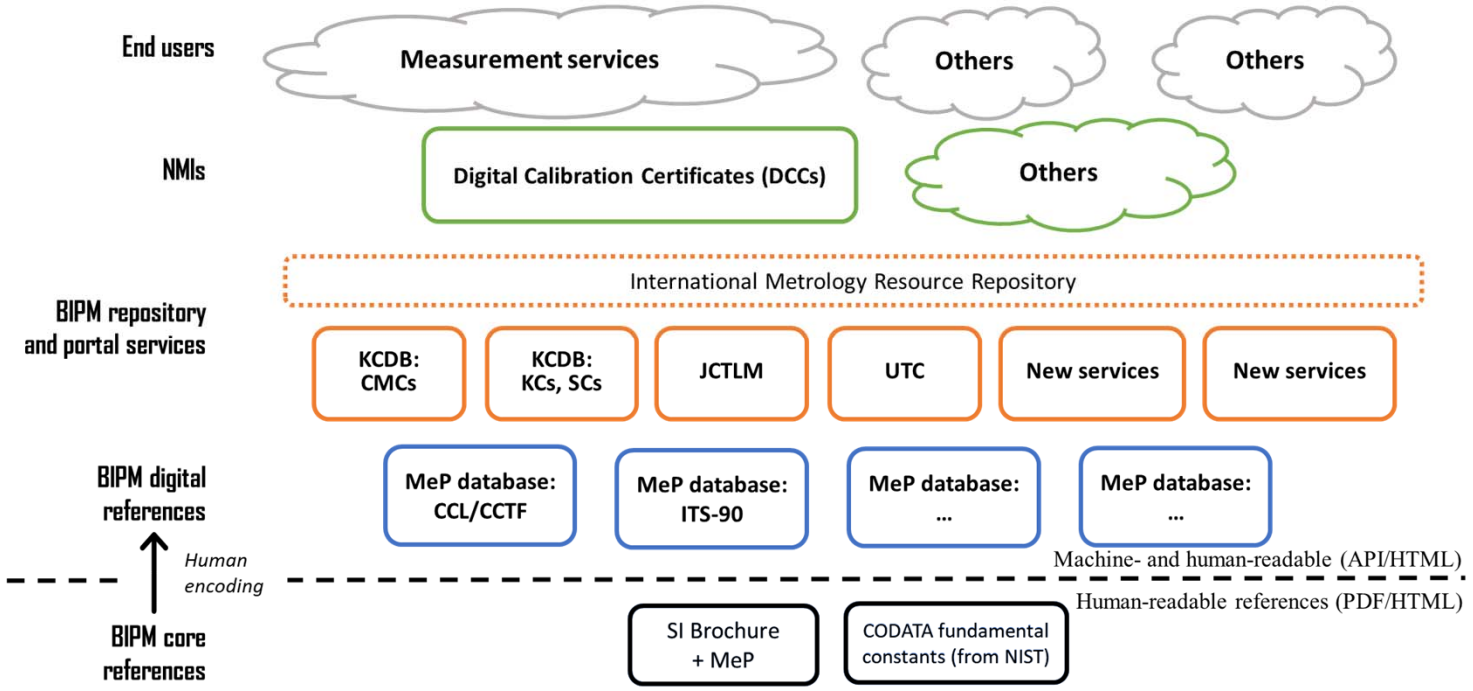
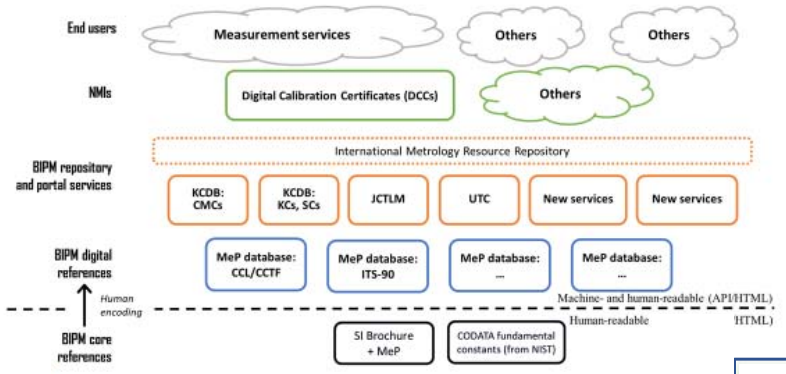
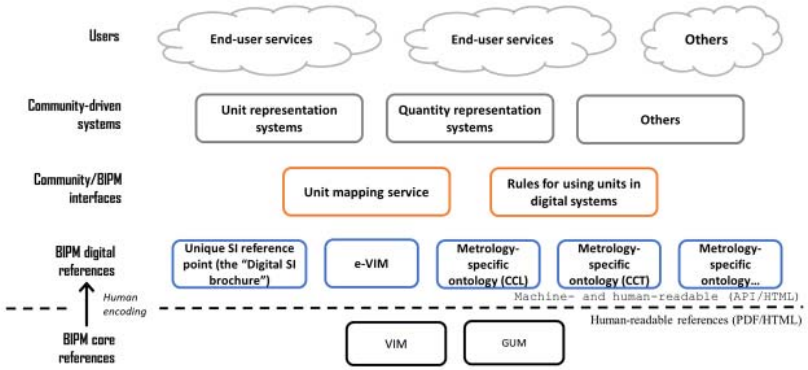


"3-star data"

The Data Plane: Findable and Accessible



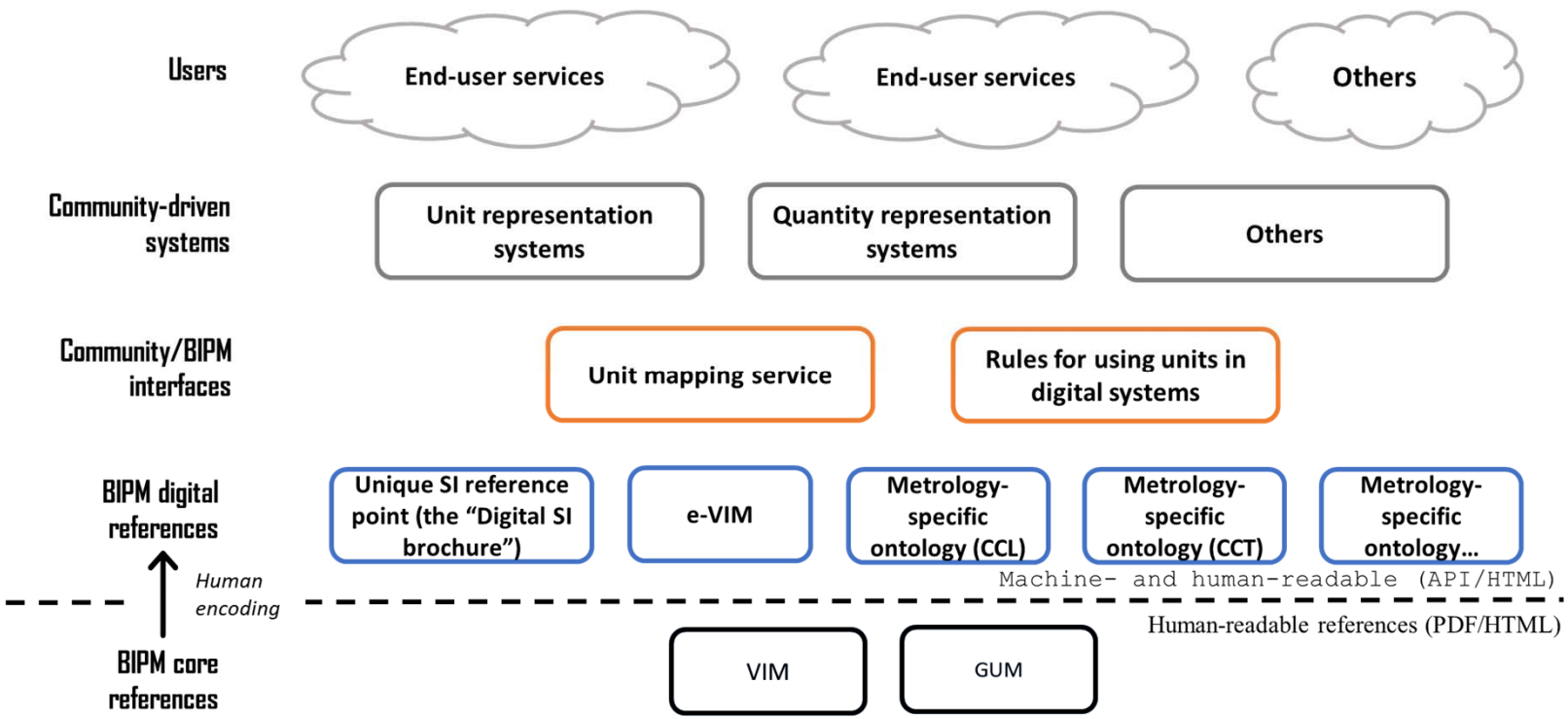
The Interoperabilty Plane: Interoperable and Reusable



"5-star data"

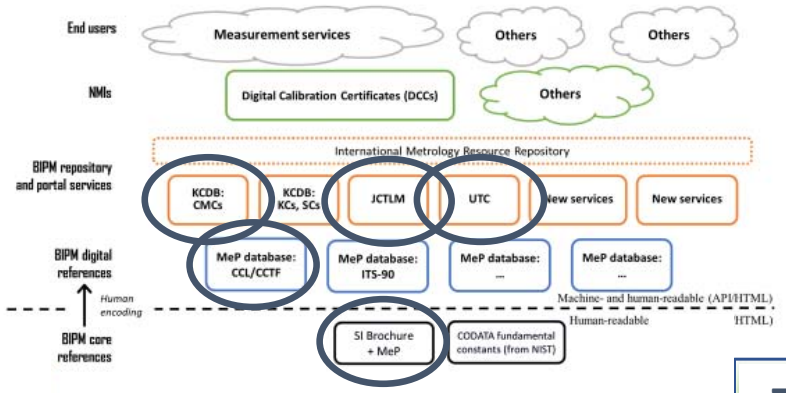
The Interoperability Plane: Interoperable and Reusable

Draft

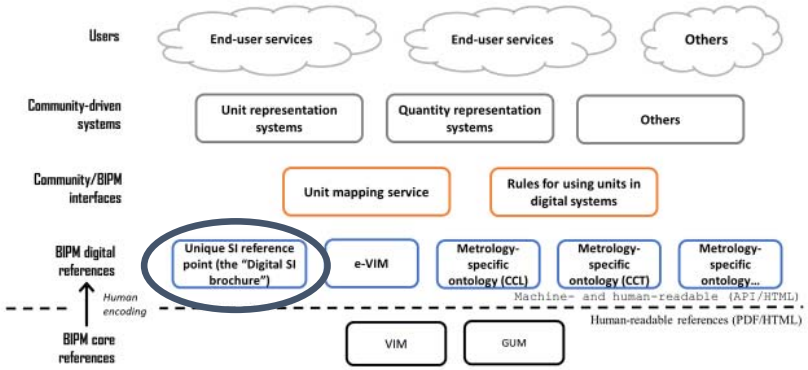


Today's talks

The Data Plane: Findable and Accessible



The Interoperabilty Plane: Interoperable and Reusable



How can BIPM support “Digital NMIs”?

- by supporting open data practices
- by implementing digital formats for metrology
- by providing machine accessible data and reference information
- to become the Trusted hub for metrology data

KCDB

JCTLM
Accurate results
for patient care

IMRR

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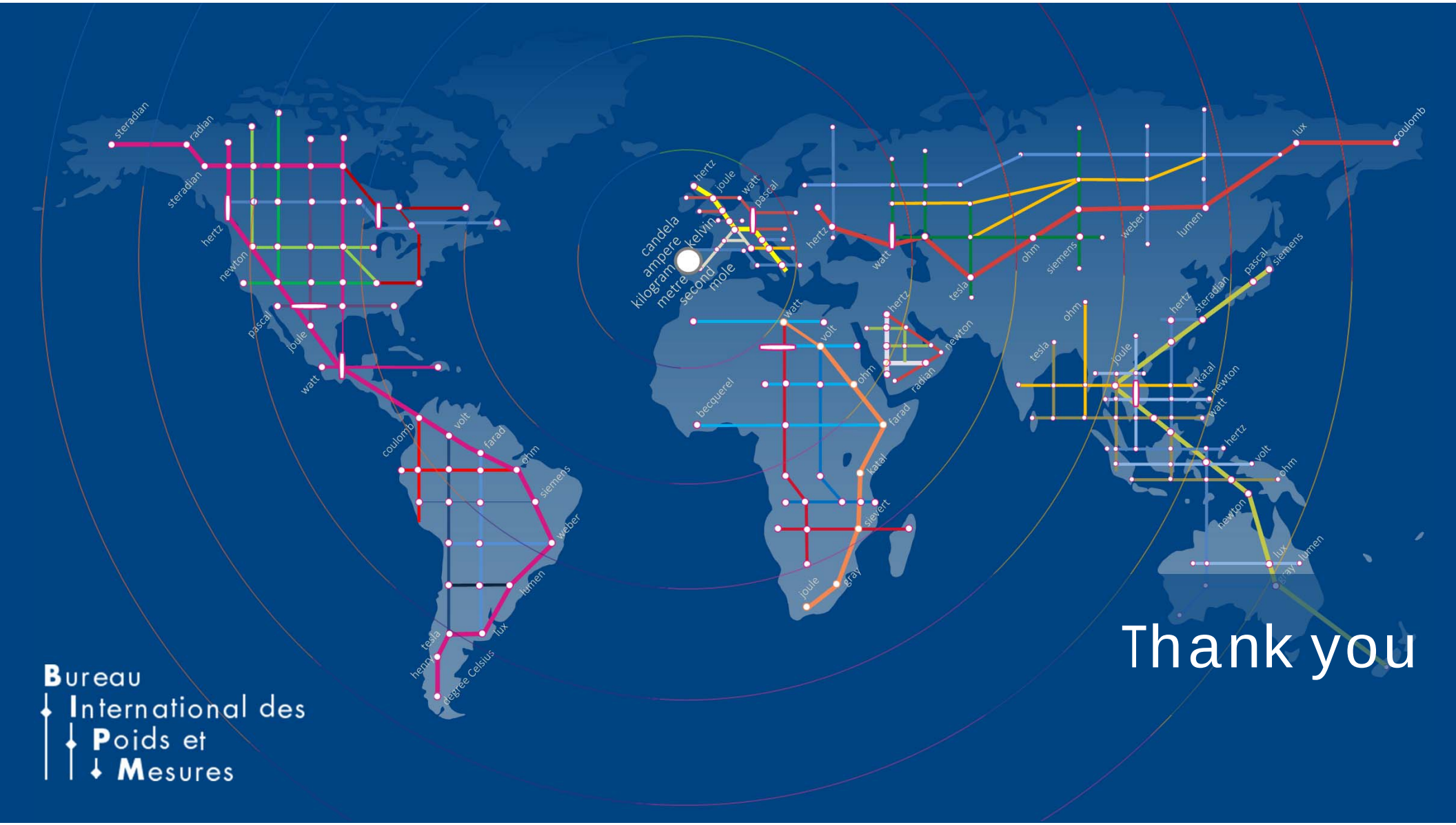
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ohm
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lux
tesla
henry
degree Celsius
candela
ampere
kilogram
metre
second
kelvin
mole
becquerel
gray
sievert
katal
radian
Thank you
Bureau International des Poids et Mesures