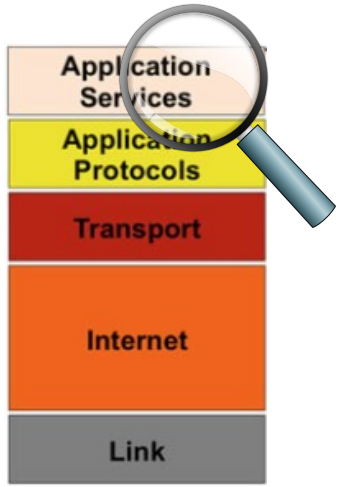
Ch. 13 - IoT Application Service Layer

Sec 7 – Standardization

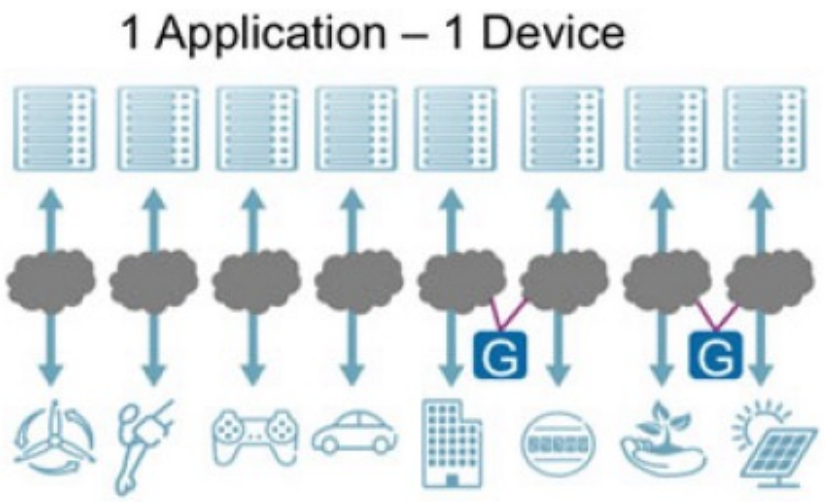
COMPSCI 147

Internet-of-Things; Software and Systems



M2M CHALLENGE I

- M2M deployments have existed for **over two decades.**
- What has characterized these deployments is a state of **fragmentation**:
  - **Vertical solutions** are implemented in **silos** with **proprietary communication stacks** and very **tight coupling** between applications and devices.
  - **"one application — one device"**

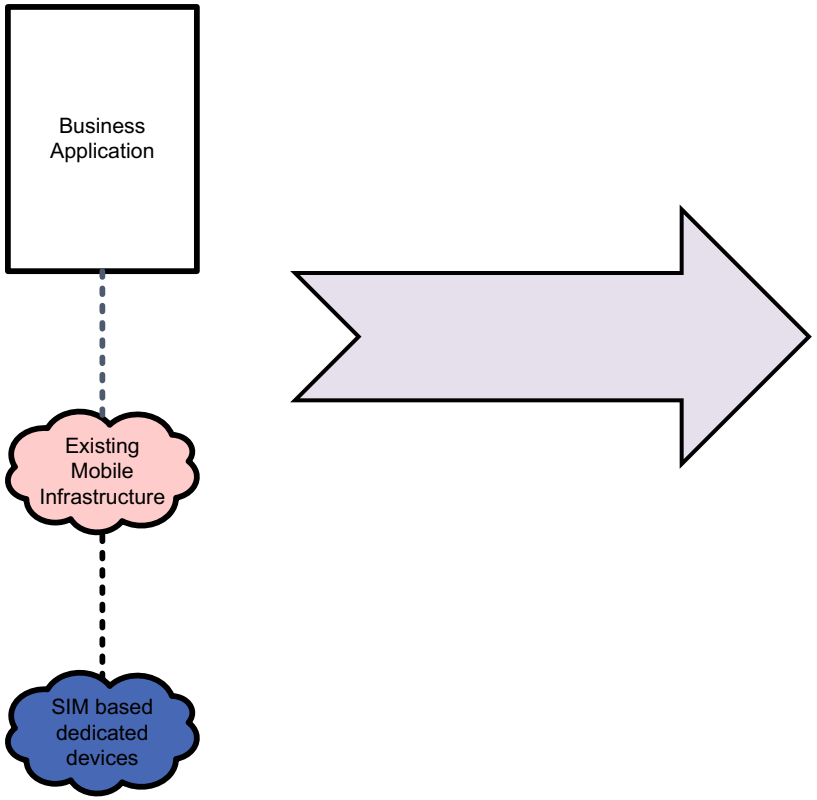


M2M CHALLENGE II

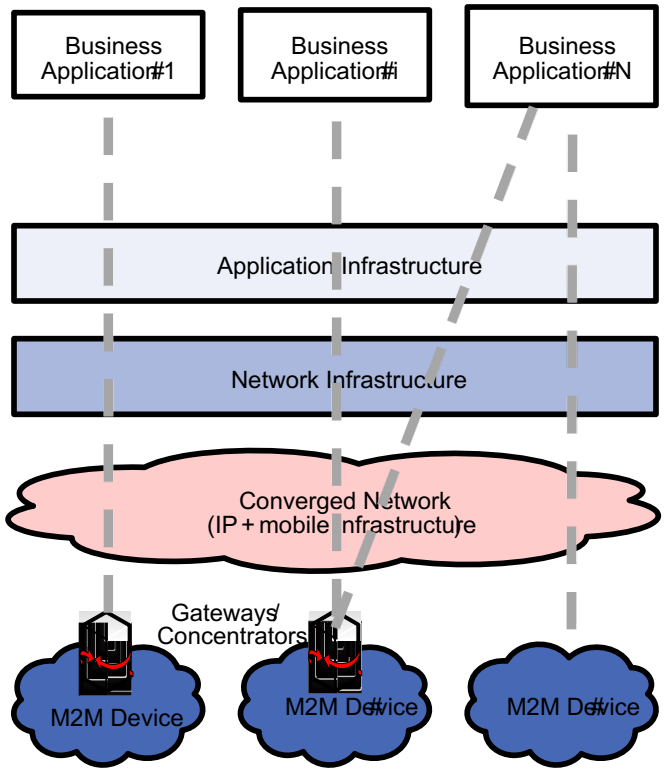
- **Multitude of technical solutions** and **dispersed standardization activities** result in the **slow** development of the M2M market
- **Standardization** is a key enabler to remove the technical barriers and ensure interoperable M2M services and networks

INVERTING THE PIPES

existing proprietary vertical applications…

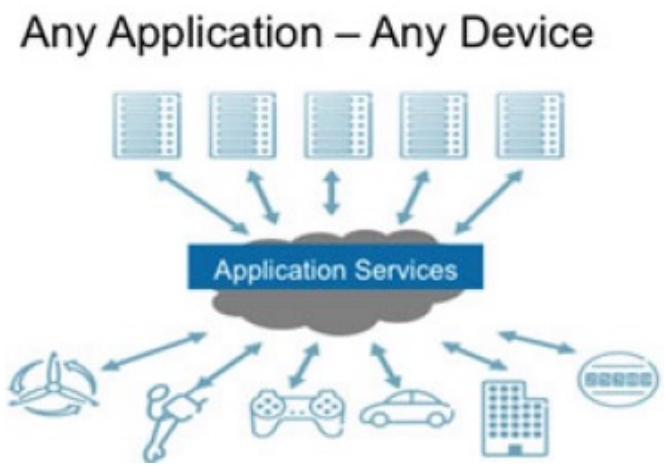


applications share **common infrastructure, environments and network elements**



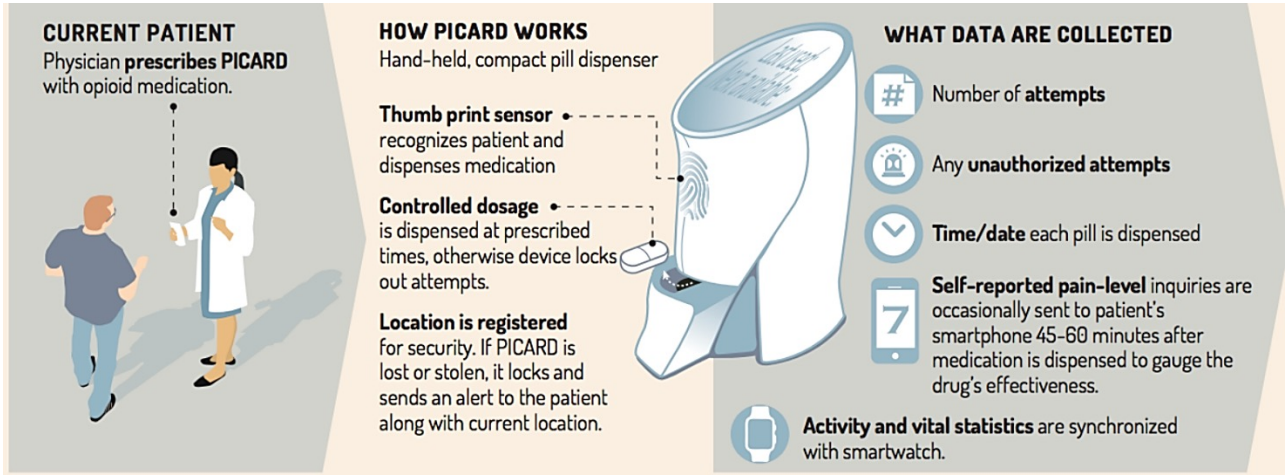
RATIONALE

- The major current gap in IoT requires **an abstraction layer** providing a common **set of services** that enables **an application to interface** with potentially **any device without understanding a priori the specifics** and **internals** of that device
- **=>** This Abstraction Layer is called **Application Services Layer**



RATIONALE II

- **Operators, integrators and vendors** have expressed the need to standardize end to end M2M
  - Communication service providers (**CSPs**) looking at using IoT to **gain additional revenue from their networks**
  - **The value of IoT is in the data**, not the way it is transported, or the specific hardware used.
- **Regulation** in Europe, USA and Asia is pushing for a standard-based solution
- It is essential to have **globally** compatible standards



e.g.: PICARD Project

INDUSTRY PROGRESS

- ETSI M2M
  - In **2012**, the European Telecommunications Standards Institute (**ETSI**) published the first release of its M2M service layer standard, which defines a **standardized platform for multiservice IoT** solutions**.**

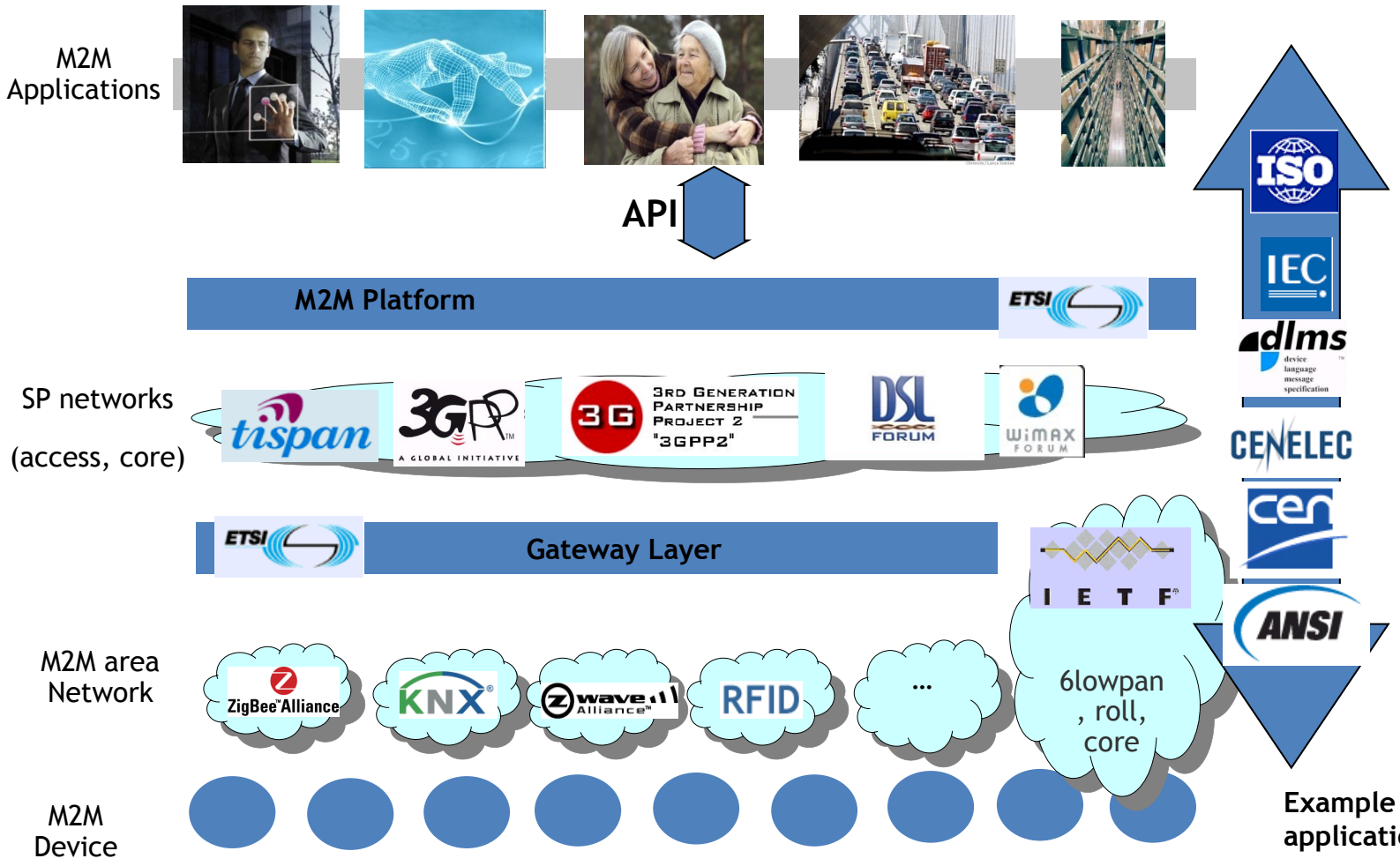
- oneM2M
  - Later that year, seven Standards Development Organizations (TIA and ATSI from USA, ARIB and TTC from Japan, CCSA from China, ETSI from Europe and TTA from Korea) launched a global organization to **jointly define and standardize the common horizontal functions of the IoT application services layer.**
  - The founders agreed to **transfer and stop their own overlapping IoT application service** layer work.
  - Release 5 in 2023 was the latest version, providing more advanced and secure IoT solutions.
  - Official website (Specs oneM2M)

INDUSTRY PROGRESS II

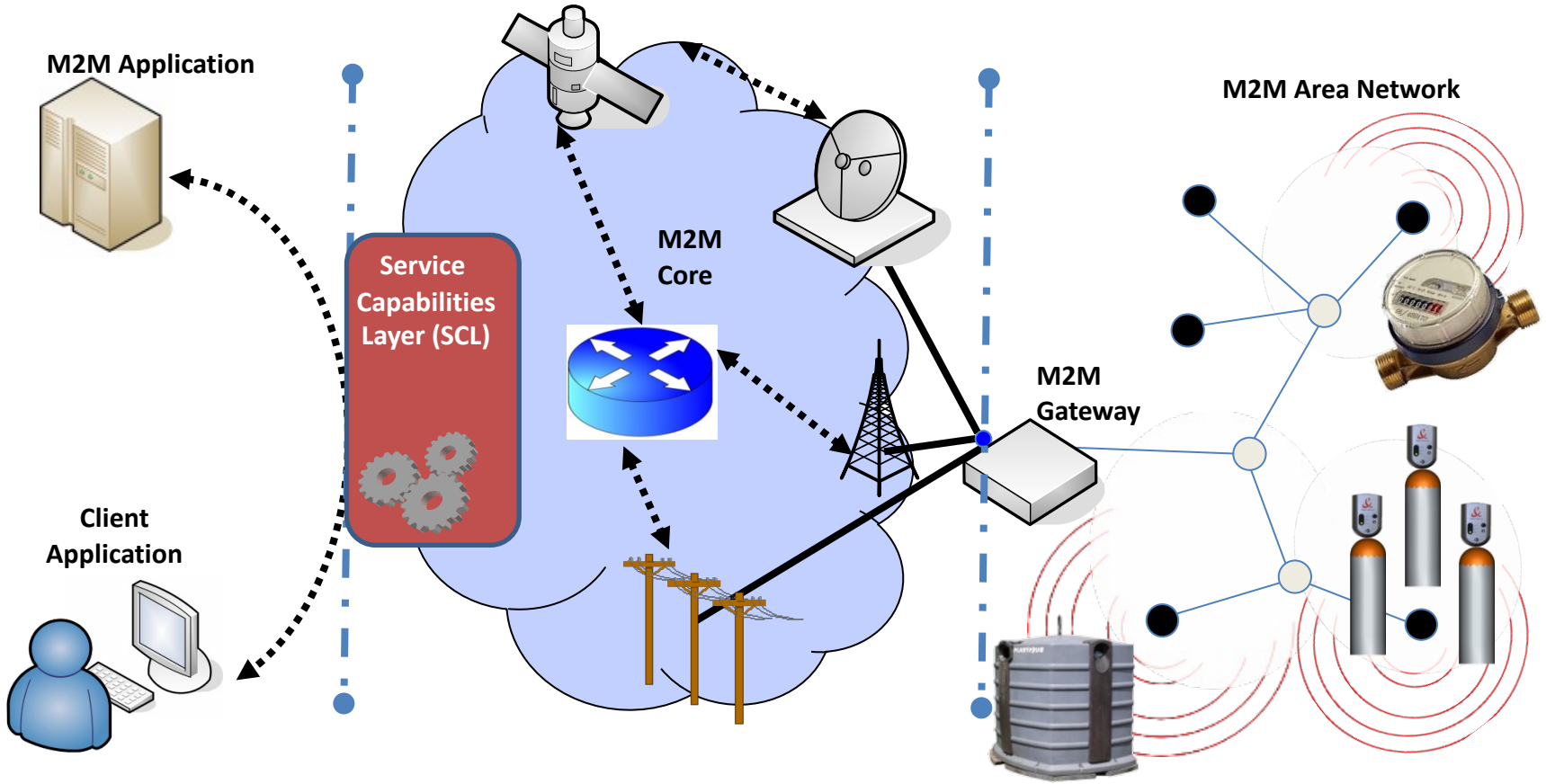
- Targeted features for an IoT Application Services Layer
  1) Network agnostic message routing
  2) Synchronous and Asynchronous communication
  3) Subscribe/Notify model (buffer support to not overload request to IoT devices)
  4) Uniform data storage model
  5) Uniform language independent of API.

- Introduction to ETSI M2M
  - https://www.youtube.com/watch?v=LLk6mHoVsLQ

CURRENT M2M STANDARDS LANDSCAPE



SIMPLE ETSI M2M ARCHITECTURE



ETSI M2M II

- Includes the vertical-specific applications (e.g., Smart Energy, eHealth, Smart City, and Fleet Management.)
- Includes Service Capabilities Layer (**SCL**)
  - A **middleware** layer that provides various **data and application services**

- The focus of the ETSI M2M standards is on defining the functionality of the SCL
- SCL provides **functions** that are **common across different applications** and expose those functions through an **open API**
- To **simplify** application development and deployment through **hiding** the network specifics

ETSI M2M - SERVICE CAPABILITIES LAYER (SCL)

- ETSI M2M adopted a **RESTful** architecture style
  - All data in the SCL is represented as **resources**
    - Data generated by the devices
    - Device information
    - Application information
    - Remote SCL information
    - Access rights information
  - Manipulation of the resources is done through a RESTful API
    - E.g., CoAP

ETSI M2M - SERVICE CAPABILITIES LAYER (SCL) II

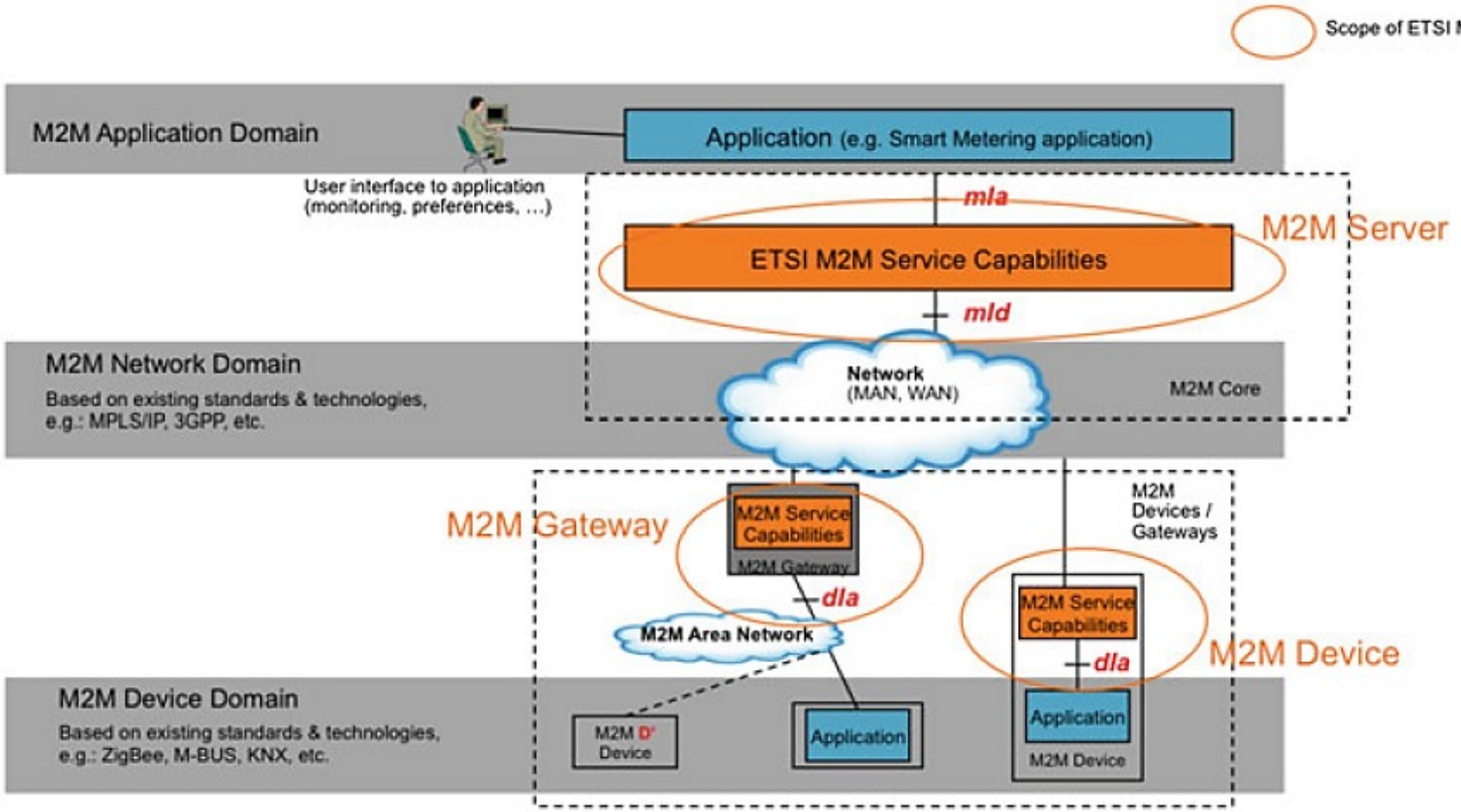
- **Device** SCL (D-SCL), **Gateway** SCL (G-SCL), and **Network** SCL (N-SCL)
  - **Share** some **common functions**, but also **differ** due to the different operations that need to be carried out by devices, gateways and network nodes (servers)

- Provide the following functions:
  - **Registration** of devices, applications, and remote SCLs
  - Synchronous and asynchronous **data transfer**
  - **Identification** of applications and devices
  - Group **management** for bulk endpoint addressability and operations
  - **Security** mechanisms for authentication, authorization, and access rights control
  - **Remote** device management (through existing protocols)
  - **Location** information

ETSI M2M - SERVICE CAPABILITIES LAYER (SCL) - INTERFACES

- Interfaces define the **semantics** of the **interactions**, and **associated API**, between the entities.
  - Three interfaces: mIa, mId and dIa
- mIa: m2**m** **A**pplication **L**ayer Interface
  - for interaction between a network application ("network domain") and a Network Service Capabilities (**NSCL**)
- mId: m2**m** **D**evice **L**ayer Interface
  - for interaction between xSCL (x={D,G,N})... for example between a GSCL and a NSCL.
- dIa: m2m **D**evice **L**ayer **A**pplication Interface
  - for interaction between a device application (in the "device domain") and a **DSCL** (Device SCL) or a **GSCL** (= Gateway **SCL**)

ETSI M2M SYSTEM ARCHITECTURE



WORK METHODOLOGY, A STEPWISE APPROACH