

## Digital Transformation for Cities and Communities

Episode #8: Network capabilities and emerging technologies to support IoT-enabled verticals

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# Introduction to emerging technologies and network capabilities for IoT-enabled verticals

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# The ITU-T definition of IoT [ITU-T Rec. Y.4000, 2012]

## Internet of Things :

A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies.

NOTE 1 - Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled.

NOTE2 - In a broad perspective, the IoT can be perceived as a vision with technological and societal implications.

# IoT and emerging technologies

The IoT is expected to benefit from the integration and convergence of ICTs and a number of emerging technologies, including but not limited to:

- Machine to Machine Communications
- Advanced Sensing and Actuation (robotics and more)
- Cloud and **Edge Computing** (towards computing continuum)
- Softwarization (software defined networking, network functions virtualization, microservices, ...)
- Advanced Networking (autonomous networks, time determinism, flexible addressing and routing, network slicing, network programmability, satellite-terrestrial network integration, ...)
- **Data Management** (abstraction, processing, sharing, exposure, governance and more)
- Artificial Intelligence/Machine Learning (devices, network and applications)
- **Digital Twin**
- Distributed Ledgers (Blockchain)
- Semantics and ontologies
- Advanced technologies for Security, Privacy and Trust (data, infrastructure, applications)

*IoT and Smart Cities standardization will reuse as much as possible the standards developed in the different technology areas, but needs also to address lacks and issues coming from their integration in IoT systems and from the (common and application domain specific) requirements of IoT and Smart Cities ecosystems' stakeholders*

# The ITU-T IoT Reference Model [Y.4000]

## Capability view of the IoT

- Application capabilities
- Service Support and Application Support capabilities
- Network capabilities
- Device and Gateway capabilities
- Cross-layer Management Capabilities
- Cross-layer Security Capabilities

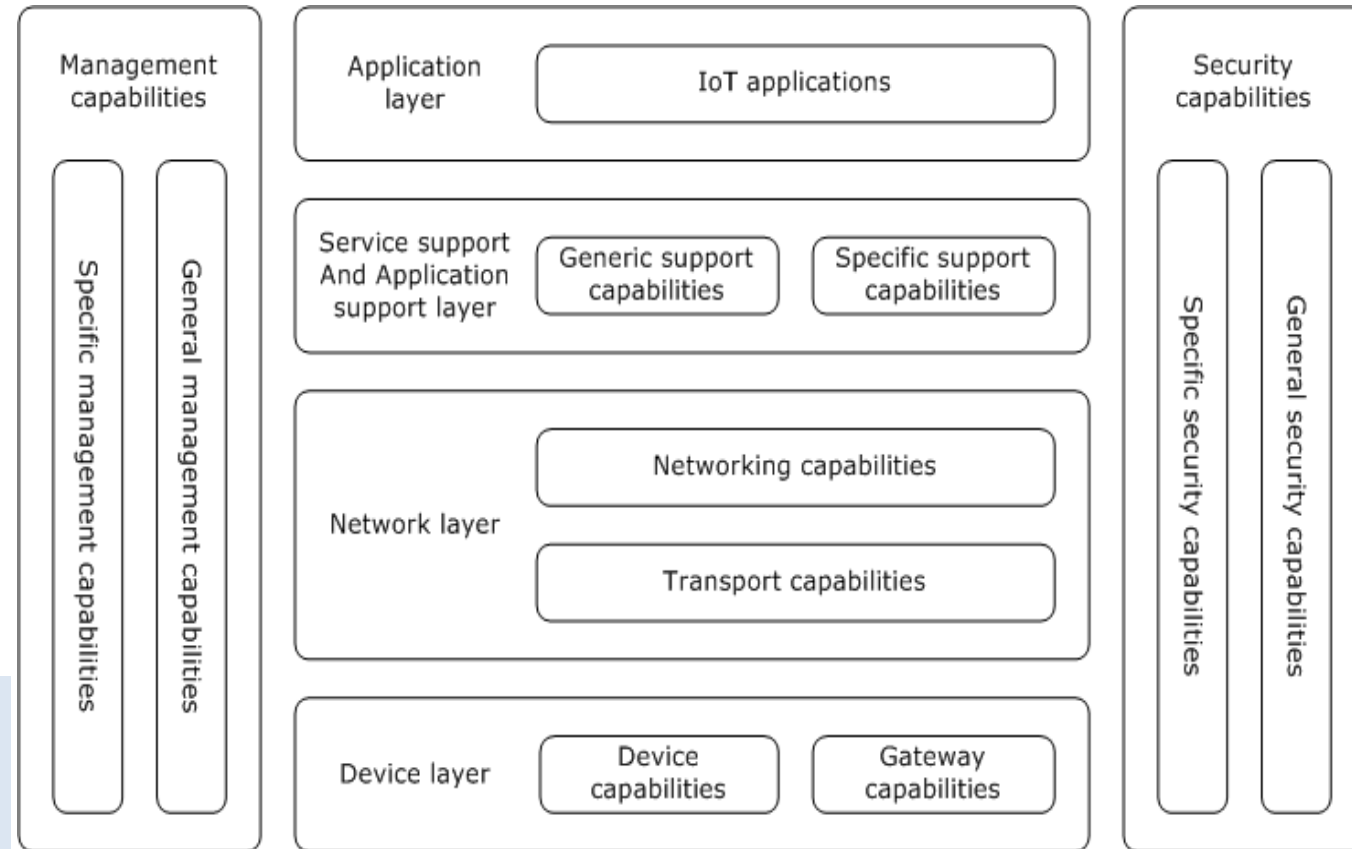
## **Common and application specific capabilities**

### Foundational ITU-T Recs on IoT include:

**Y.4000** Overview of the IoT

**Y.4100** Common requirements of the IoT

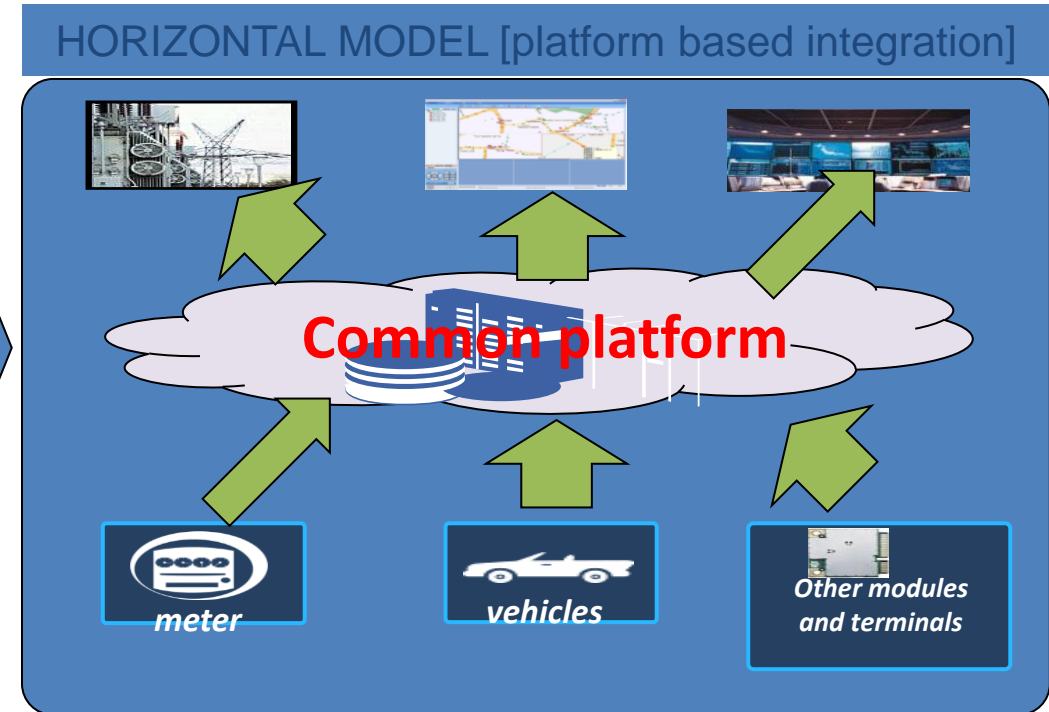
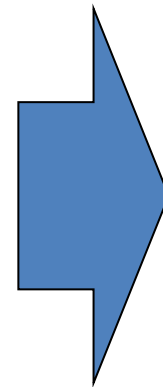
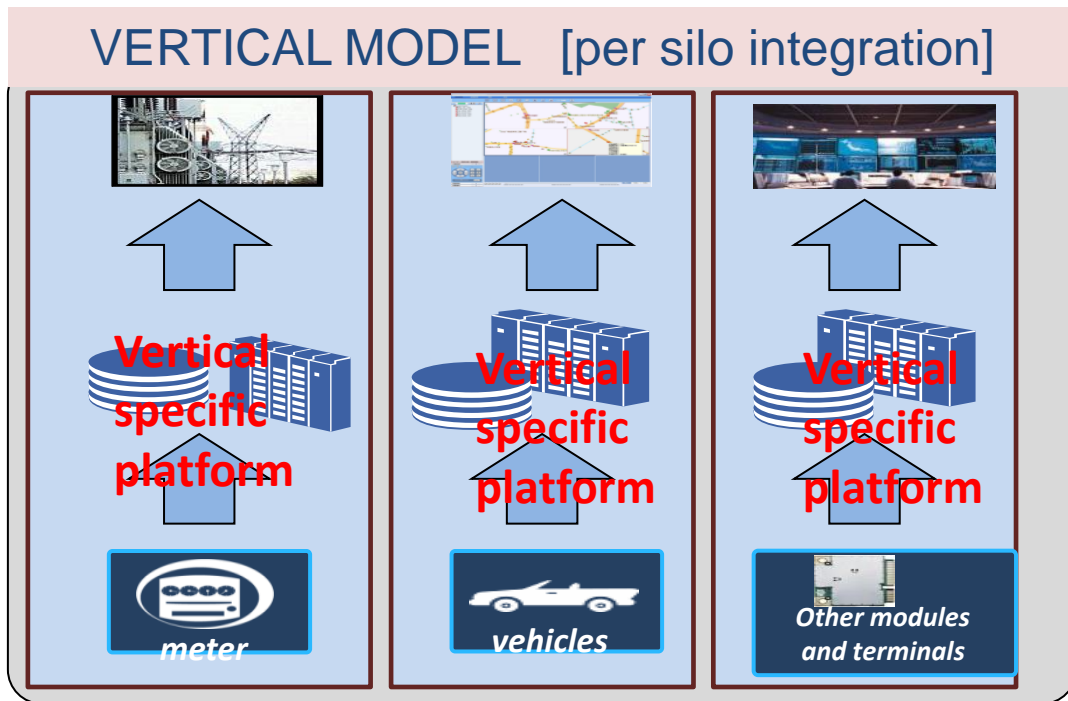
**Y.4401** Functional framework and capabilities of the IoT



Source: ITU-T Y.4000

# From vertical specific platforms to horizontal (common) platforms

*The situation of technology separation among IoT application domains produces market separation*



*Per silo integration does not scale and limits the evolution possibilities*

*Platform based integration is needed with the key role of open standards and open source*

**Deployment reality: different (application domain specific) platforms will co-exist and need to interoperate**

# ITU-T Q2/20 “Requirements, capabilities and architectural frameworks across verticals enhanced by emerging digital technologies”

- “One essential objective is the **maximization of the usage of common capabilities and architectural frameworks** in order to provide support to a broad range of IoT and SC&C services and applications in different verticals, in cost efficient, multi-vendor and easily deployable ways over converged infrastructures.”
- “In the IoT there is an increasing integration and convergence of Information and Communication Technologies (ICTs) and emerging digital technologies ... **These technologies are making available a large set of advanced capabilities** for the support of IoT and SC&C services and applications, **which need to be integrated in terms of architectural frameworks, from both common (not vertical dependent) and vertical specific viewpoints.**”
- “On the basis of use cases and related ecosystem aspects, **the requirements, capabilities and architectural frameworks** enhanced by emerging technologies for the support of IoT and SC&C services and applications **will be specified from both common (not vertical dependent) and vertical specific viewpoints.**”

Q2/20 work programme is accessible via [https://www.itu.int/ITU-T/workprog/wp\\_search.aspx?sg=20](https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=20)

**Thanks for your attention**