Global Future Internet Week 2011

Y.3001 Future Networks: Objectives and Design Goals

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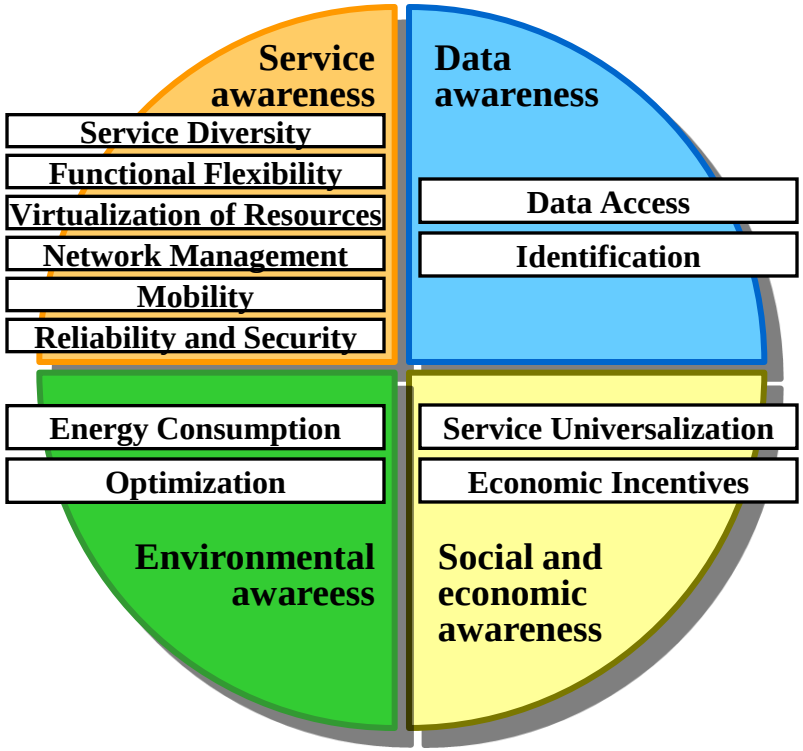
Scope and Current Status

- ITU-T SG13 Q21 has delivered three Recommendations
  - Y.3001(Vision: Objectives and Design Goals, Y.3011(Network virtualization), Y.3021(Energy saving)
- Y.3001 document mainly describes
  - Objectives(clause 7): fundamental issues that are not paid enough attention in designing today's networks and should be the objective of Future Networks.
  - Design Goals(clause 8): capabilities that should be supported by future networks.
  - Promising Technologies(clause 9): ideas and research topics of future networks that are important and may be relevant to future ITU-T standardization.
- Vision document states the fundamental guiding principles for upcoming future networks standardizations in ITU-T.
- Recommendation Y.3001 can be found at: http://www.itu.int/itu-t/recommendations/index.aspx?ser=Y

Overview of Y.3001

- Title: “Future Networks: Objectives and Design Goals”
- Specifies 4 objectives and 12 Design Goals of Future Networks.



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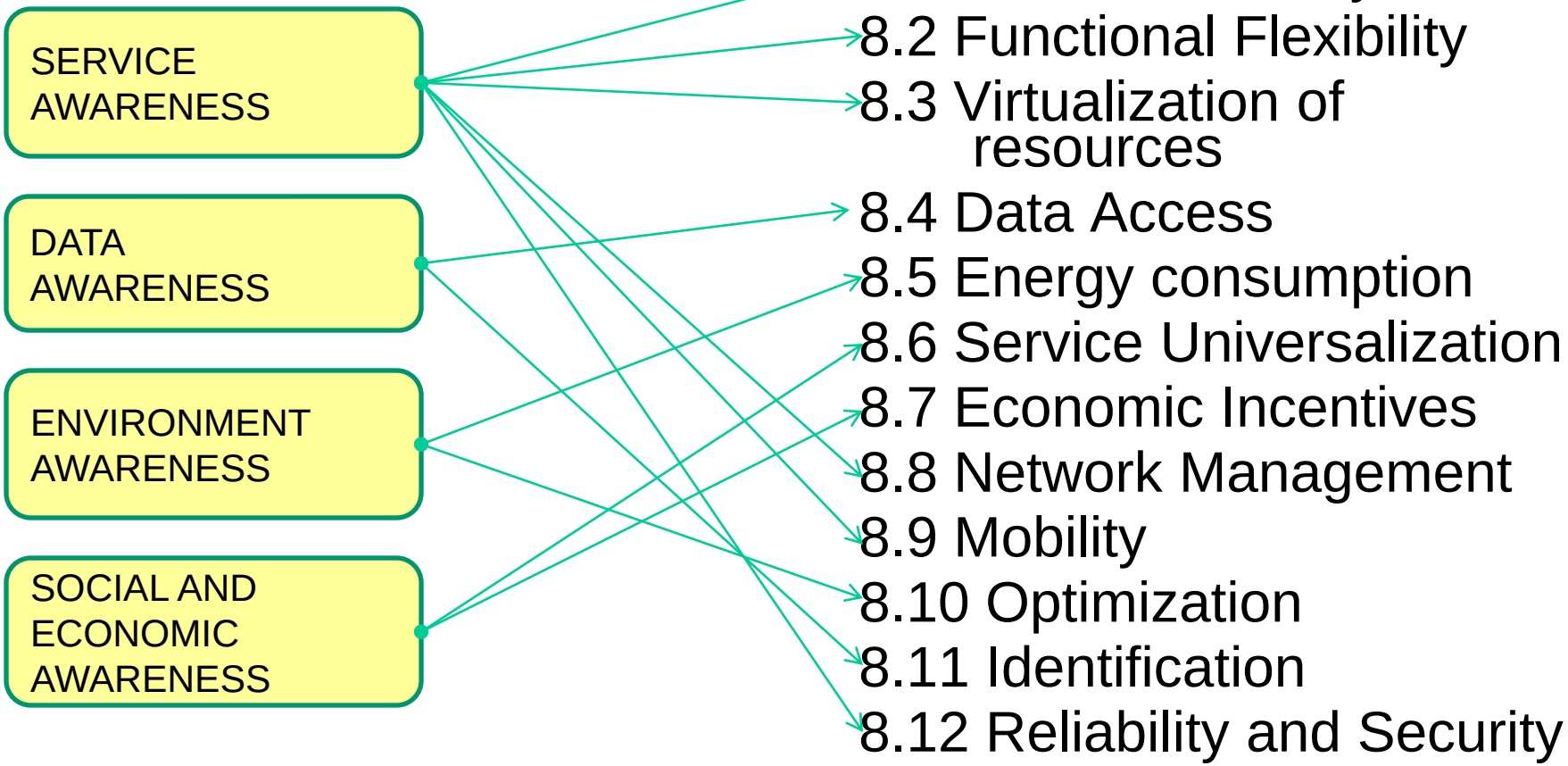
Clause 7 : Objectives

- Service awareness
  - FNs should provide services that are customized with the appropriate functions to meet the needs of applications and users.
- Data awareness
  - FNs should have architecture that is optimized to handling enormous amount of data in a distributed environment.
- Environment awareness
  - FNs should be environmentally friendly.
- Social and economic awareness
  - FNs are recommended to consider social and economic issues to reduce barriers to entry for the various actors involved in the network ecosystem.

Clause 8 : Design Goals



Clause 8.1 : Service diversity

FNs are recommended to support diversified services accommodating a wide variety of traffic characteristics and behaviors. FNs are recommended to support a huge number and wide variety of communication objects such as sensors and terminal devices.

Clause 8.2 : Functional Flexibility

FNs are recommended to offer functional flexibility to support and sustain new services derived from user demands. FNs are recommended to support agile deployment of new services keeping pace with their rapid growth and change.

- “Functional programmability” and “elasticity” capability of Network virtualization is one of the strong candidate for this objective. (see Y.3011)

Clause 8.3 : Virtualization of resources

FNs are recommended to support virtualization of resources associated with networks in order to support partitioning of resources, and a single resource can be shared concurrently into multiple virtual resources. FNs are recommended to support isolation of any virtual resource from all others. FNs are recommended to support abstraction in which a given virtual resource need not directly correspond to its physical characteristics.

- Virtualization is actually a method to realize programmability, etc. (see Y.3011)

Clause 8.4 : Data Acess

FNs are recommended to be designed and implemented for optimal and efficient handling of huge amounts of data. FNs are recommended to have mechanisms for promptly retrieving data regardless of their location.

- This design goal is related to CCN, DONA, PSIRP, NetInf, etc.
- Future works are planned for this area.

Clause 8.5 : Energy consumption

FNs are recommended to use device-, equipment-, and network-level technologies for improvement of energy efficiency and satisfaction of customers' demands with minimum traffic. These technologies are recommended to not work independently, but cooperate with each other as a total solution for network energy savings.

- Handled in Y.3021 (Energy-savings of networks).

Clause 8.6 : Service universalization

FNs are recommended to facilitate and accelerate provision of facilities in differing areas such as towns or countryside, developed or developing countries, by reducing lifecycle costs of the network and through open network principles.

Clause 8.7 : Economic incentives

FNs are recommended to be designed to provide a sustainable competition environment for the range of participants in the ICT/telecommunication ecosystem—such as users, various providers, governments, and IPR holders—by providing proper economic incentive.

- This design goal relates to “tussles in the internet” mentioned in D. Clark’s paper “Tussle in Cyberspace: Defining Tomorrow’s Internet.” Future works are planned for this area.
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Clause 8.8 : Network management

FNs are recommended to be able to efficiently operate, maintain, and provision the increasing number of services and entities. In particular, FNs are recommended to be able to process massive amounts of management data and information efficiently and effectively transform these data to relevant information and knowledge for the operator.

- Very important but difficult area to tackle. Autonomous management system is one candidate.
- (Future works are planned for this area.)

Clause 8.9 : Mobility

FNs are recommended to provide mobility that facilitates high-speed and large-scale network in an environment where a huge number of nodes can dynamically move across heterogeneous networks. FNs are recommended to support mobile services irrespective of node's mobility capability.

- Required for IoT networking.

Clause 8.10 : Optimization

FNs are recommended to provide sufficient performance by optimizing network equipment capacity based on service requirement and user demand. FNs are recommended to perform various optimizations within the network with consideration of various physical limitations of network equipments.

- This design goal tries to find an alternative to over-provisioning.

Clause 8.11 : Identification

FNs are recommended to provide a new identification structure that can effectively support mobility and data access in a scalable manner.

- Also relates to “Data access” and “Mobility” design goals.

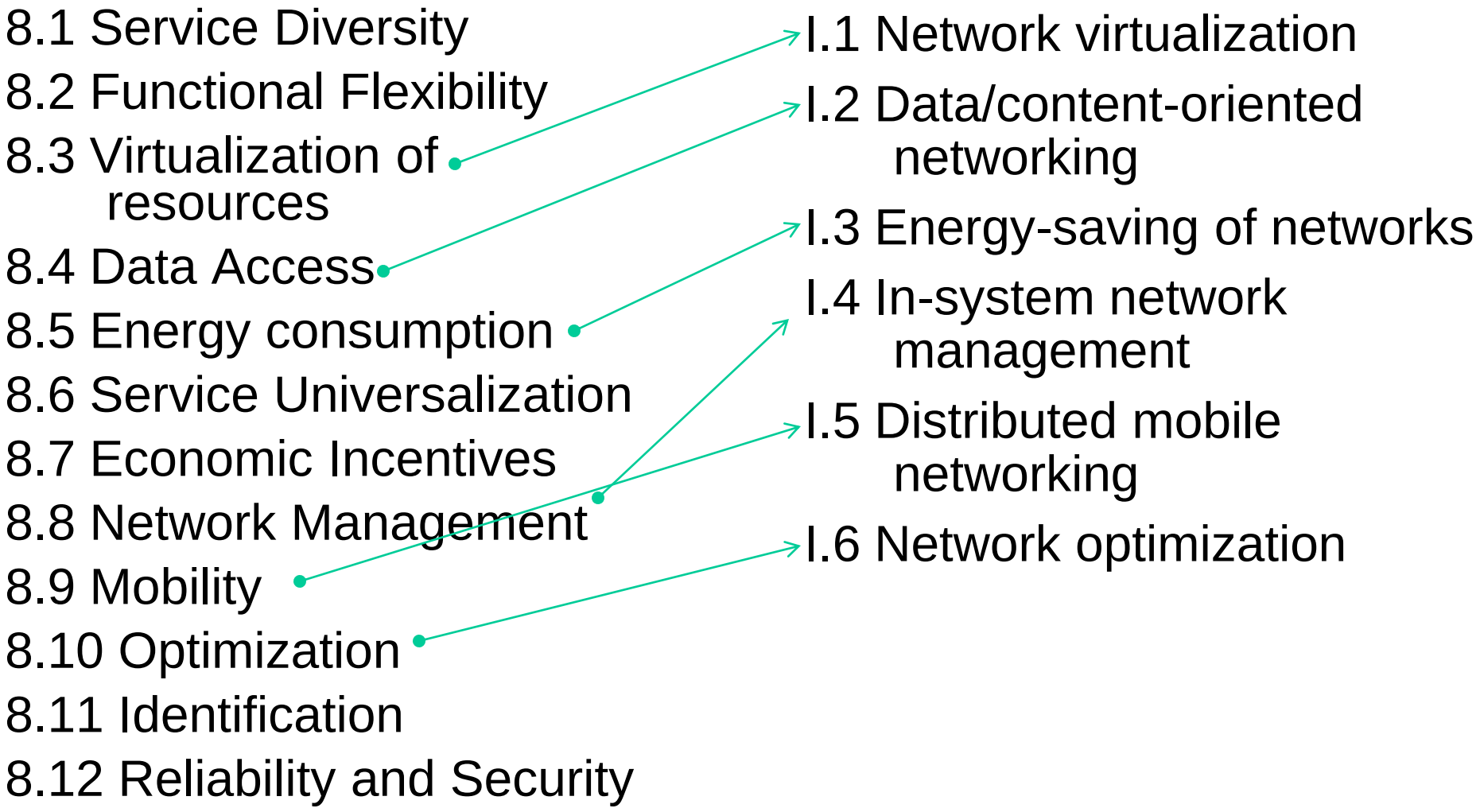
Clause 8.12 : Reliability and security

FNs are recommended to be designed, operated, and evolved for resilience towards challenging conditions. FNs are recommended to be designed for safety and privacy of their users.

Clause 9 : Target Date

- Long-term, (revolutionary) approach
  - The estimated target date for prototyping and phased deployment of FNs should roughly fall between 2015 and 2020.
  - This estimate is based on two factors:
    First, the status of current and evolving technologies that would be employed in the experimentation and development of FNs.
    Second, any novel development that might take place well beyond that estimate is too speculative and is outside the mandate of this document.

Appendix 1 : Technologies for achieving the design goals



I.1 Network Virtualization

- Network virtualization is the technology that enables the creation of logically isolated network partitions over shared physical network infrastructures so that multiple heterogeneous virtual networks can simultaneously coexist over the shared infrastructures.
- Also, network virtualization allows the aggregation of multiple resources and makes the aggregated resources appear as a single resource.

1.2 Data/content-oriented networking

- Several networking methods focusing on data/content distribution have been proposed
  - Content Centric Networking (CCN),
  - Named Data Networking (NDN),
  - Data Oriented Network Architecture (DONA),
  - Network of Information (NetInf), etc.

I.3 Energy-saving of networks

- Energy-saving of networks has the following three promising areas
  - Forward traffic with less energy
  - Control device/system operation for traffic dynamics
  - Satisfy customer requests with minimum traffic
- A newly implemented service may increase energy consumption, but networks with energy-saving technologies can mitigate this increase.

I.4 In-system network management

- Two Candidate Functions
  - A unified operation and management system from the perspective of highly efficient management,
  - Sophisticated control interface and inheritance system of operator knowledge and knowhow for network operation and management by lower-skilled operators.
- Two approaches are proposed
  - “Common interface for operation and management”
  - “Sophisticated control interface and inheritance system of operators knowledge and know-how”.

I.5 Network optimization

- To improve its effectiveness of use in a sense that network provides optimal (i.e. not abundant) capabilities for user needs.
- Three promising areas :
  - Device level optimization
  - System level optimization
  - Network level optimization
    - Path optimization
    - Network topology optimization
    - Accommodation point optimization

I.6 Distributed mobile networking

- By flexibly locating functionalities at any part of the network in a distributed fashion, a highly efficient and scalable mobile network can be realized
  - localize and optimize the signaling and data paths
  - enable the network administrator to control the signaling and data path
  - locate the functional entities (e.g., mobility management) anywhere in the network (both in the mobile core and access networks)
  - connect devices not fully capable of mobility and/or security without degrading those features

Future Plans

- Y.3001 and framework documents of 2 important research areas (Y.3011: network virtualization, Y.3021: energy savings) have been consented. We plan to move on to develop use case and requirement documents for these areas.
- We also plan to develop framework documents regarding data awareness and socio-economic awareness.

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