ITU Workshop on "Standardization on IMT, M2M, IoT, Cloud Computing and SDN"

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Smart Ubiquitous Networks: Standardization and Challenges for Smartness of Networks

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- SUN – overview
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SUN standardization activities – 1

- Discussion on the SUN in 2011 January meeting
  - Reached a consensus that NGN developments are stable and mature enough within SG13 key mandates (develop requirements and architectures)
  - Proposed and agreed "Smart Ubiquitous Networks (SUN)" as a new vision of SG13
  - Made a draft definition on "SUN"
- Proposal for standardization of SUN in SG13 (May 2011)
  - Have a common understanding of SUN
  - Identify new features and issues of SUN
  - Develop relevant Recommendations on SUN
  - ➔ SUN ad-hoc meetings (July 2011 and September 2011)

SUN standardization activities – 2

- Key findings and open issues of SUN ad-hoc meetings
  - SUN has attracted attention.
    - 31 contributions were submitted to the two meetings.
  - Technical meaning of 'smart' identified.
    - Through discussion, it was recognized that smart means 'context awareness' in technical sense.
    - A system is called smart when its behaviour changes appropriately in response to various context, e.g., location, price, and previous behaviour.
  - Three initial work items has been identified.
    - Three of them, context aware, content aware and smart resource management has attracted particular attention.
  - Relationship with NGN and FN
  - Necessity of consolidated architecture
- Start to develop 4 draft recommendations (October 2011)

SUN standardization activities – 3

- Key results of SUN standardization in ITU-T
  - 4 Recommendations
    - Y.3041 (Overview of smart ubiquitous networks), April 2013
    - Y.3042 (Smart Ubiquitous Networks - Smart Traffic Control and Resource Management Functions), April 2013
    - Y.3043 (Smart ubiquitous networks - Context awareness framework), August 2013
    - Y.3044 (Smart ubiquitous networks - Content awareness framework), August 2013
  - 1 on-going draft recommendation
    - Y.SUN-cdf (Smart ubiquitous networks - Functional architecture of content delivery)

SUN - Overview

- This Recommendation
  - Describes overview of Smart Ubiquitous Networks (SUN) with identifying high level features of SUN including requirements of these features (and also identifies design principles of SUN)
    - Necessity of SUN from social, network innovation and network capabilities aspects in smart ubiquitous environment
    - Concept of the SUN (e.g., Definition and key characteristics of SUN);
    - High level features of SUN
    - High level requirements of SUN

Smart Ubiquitous Networks

- Definition of SUN
  - Smart ubiquitous networks are IP-based packet networks that can provide transport and delivery a wide range of existing and emerging services to people and things.
  - The services provided by the networks can cover aspects such as control, processing and storage.
  - The networks are **smart** in the sense that they are knowledgeable, context-aware, adaptable, autonomous, programmable and can effect services effectively and securely.
  - The networks are **ubiquitous** in the sense that they allow access anytime anywhere through varied access technologies, access devices including end user devices, and human-machine interfaces.

Why "Smart"?

- Innovative communication
  - Knowledge-based: from person, service and network
- Autonomics
  - Self and adaptive networking with OAM&P
- Context-Awareness
  - Awareness of applications, location, energy, environment
- Without human intervention
  - Collaborating among networks, devices, content and applications

Smart Networks consists of ***distributed*** control and management systems.

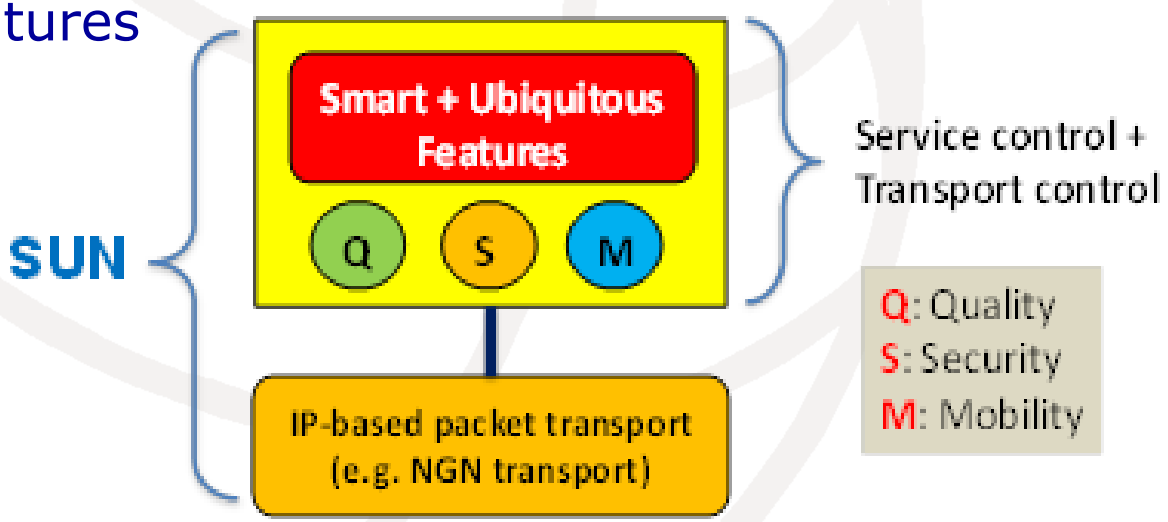
Why "Ubiquitous"?

- At any where
  - The capacity to access and use a specific service through different access technologies and physical devices
- At any time
  - The service must be "always-on"
- With any object
  - Enabling the use of a wide variety of non-PC equipment

Ubiquitous Networks consists of innumerable number of computing devices embedded in almost everything around us, platforms and networks that interconnect them, and user devices that make use of and act on the available information.

Smart Ubiquitous Networks

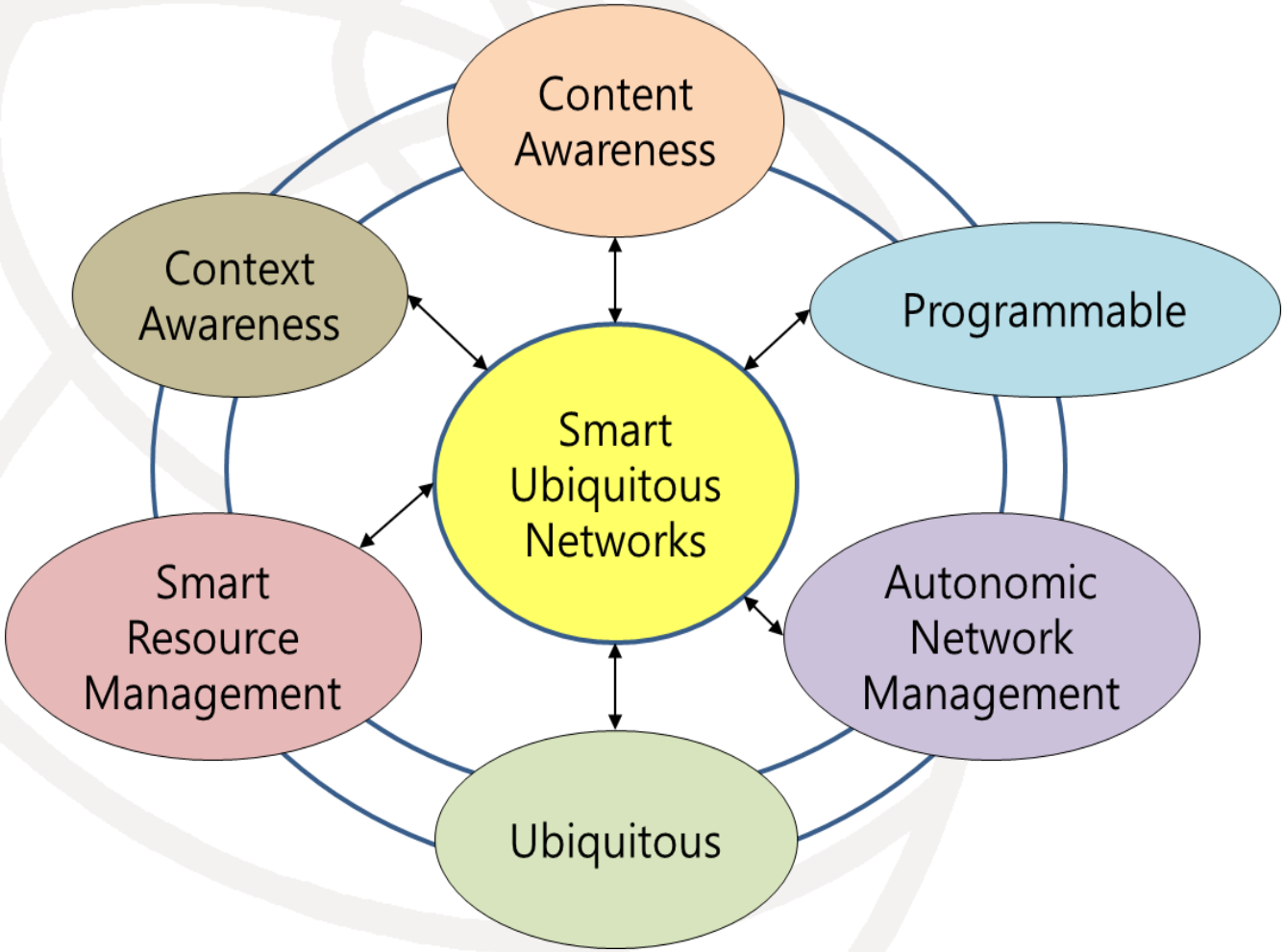
- From the definition of SUN, functional features:
  - Based on the IP-based packet transport same as NGN with secure of services
  - Support **"Things"** as well as support "People"
  - cover "Processing and Storage" which are beyond NGN coverage
  - Have features of "knowledgeable, context-aware, adaptable, autonomous and programmable" which are partially covered by NGN but SUN should provide wider scopes and better ways to support these features



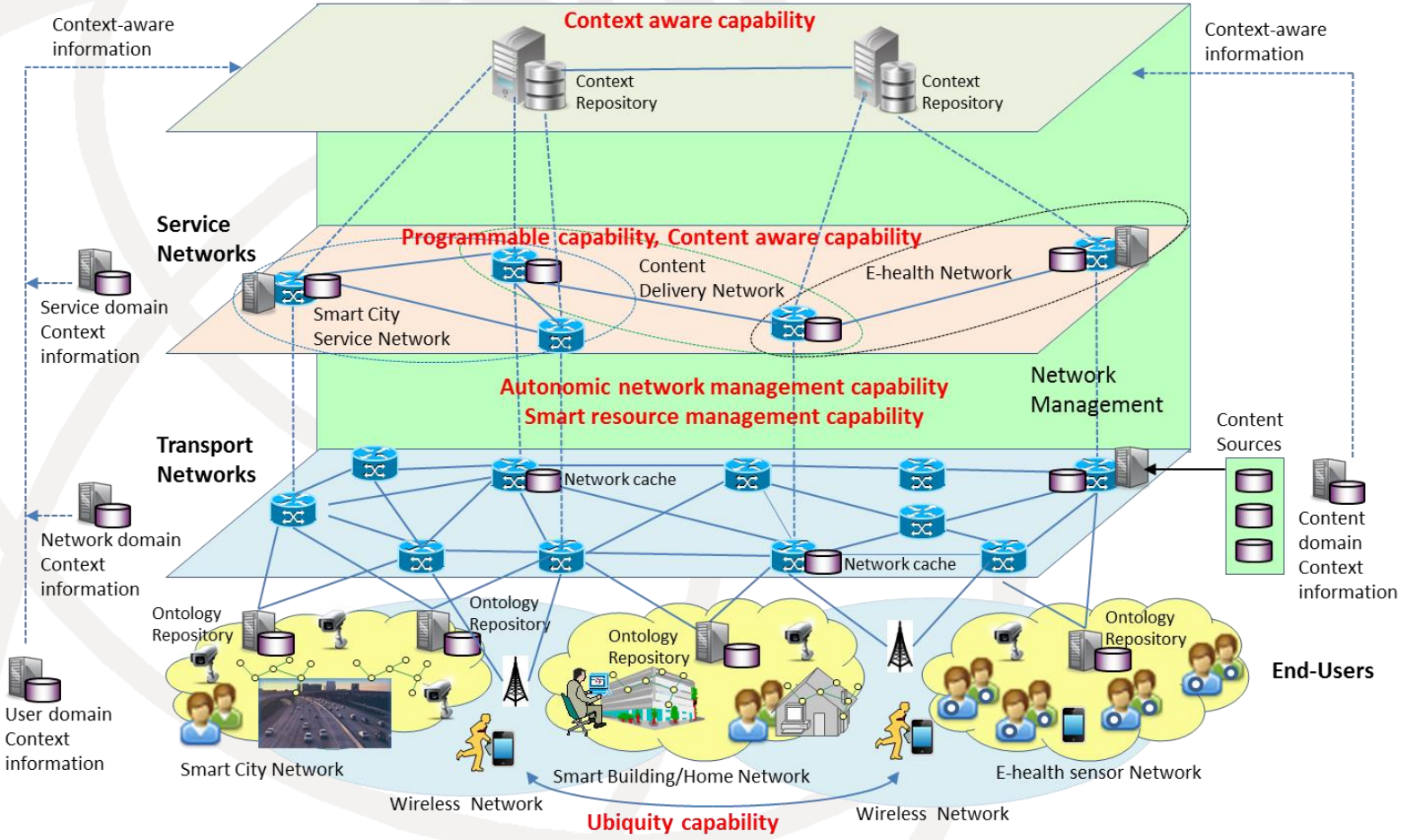
SUN as a short term realization of FNs

- SUN use IP-based environment, but add more capabilities to support services in smart ways taking into account the knowledge resulting from the context awareness.
- A key objective of SUN is an enhancement of networking capabilities of IP-based networks by an optimized and efficient use of various resources (e.g., resources for networks, services and end user devices), for the benefit of not only human beings but also things.
- With this enhancement, SUN support various services and applications, taking into account the context of the end user, the network and service provisioning.

Key features of SUN



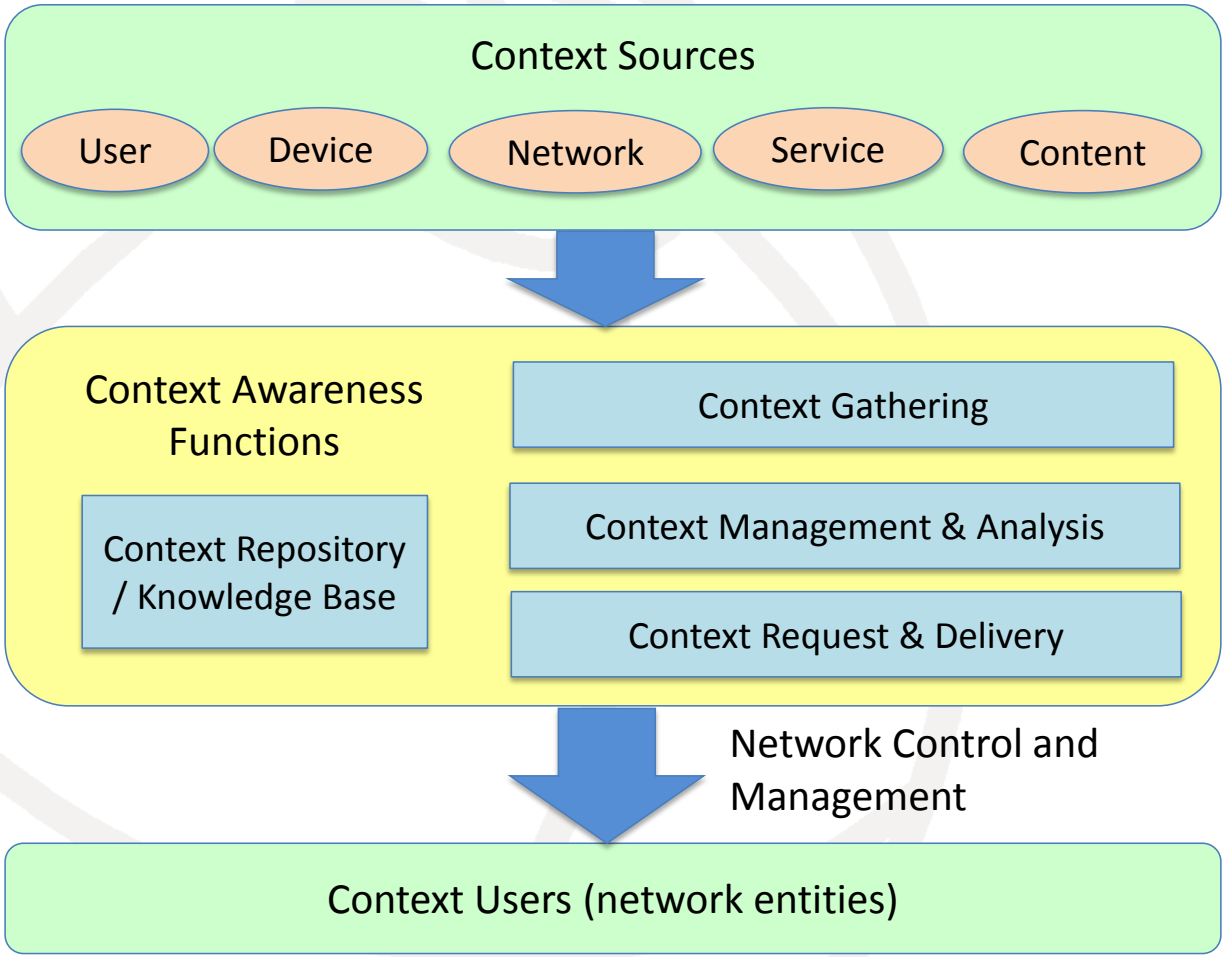
High-level architecture of SUN



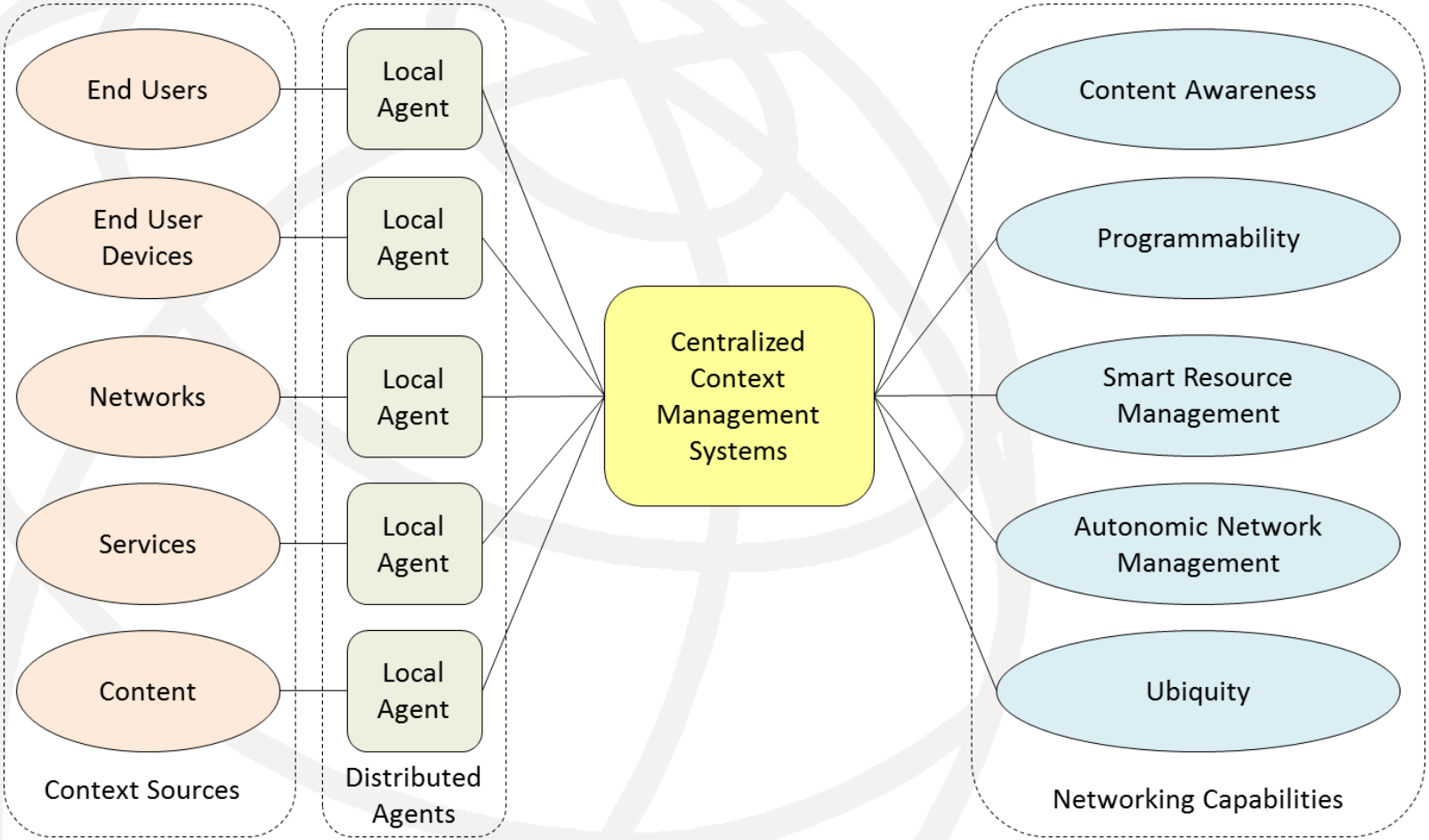
SUN – Context Awareness

- Context awareness capability of SUN
  - Enables networks to dynamically capture context information and monitor the context change in order to be adaptive based on user characteristics and the environment
- Context awareness provides the following characteristics
  - Distributed control and management of context sources
  - The reduction of complexity
  - The incorporation of autonomics

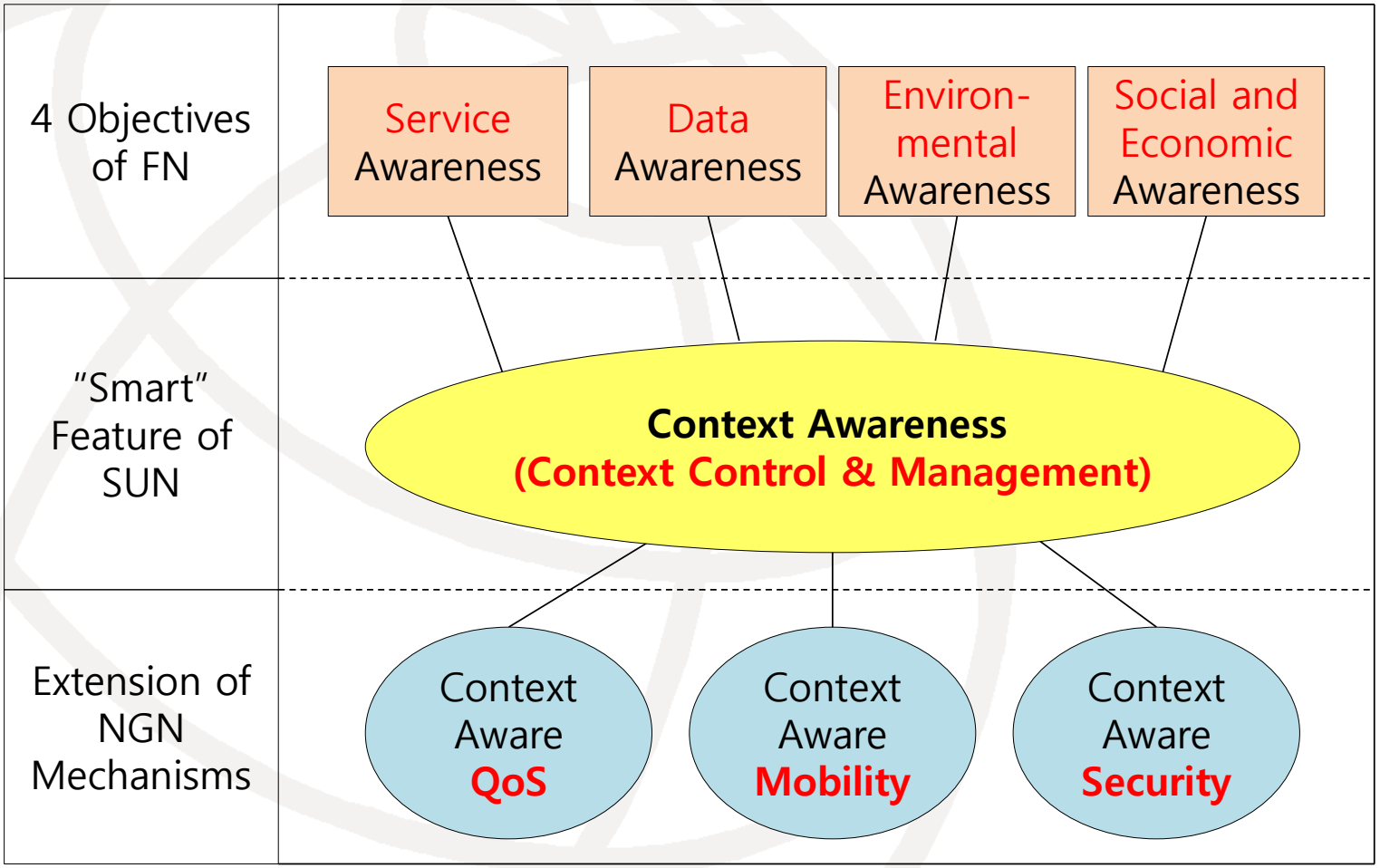
High level functional model for context awareness in SUN



Context awareness to support other networking capabilities



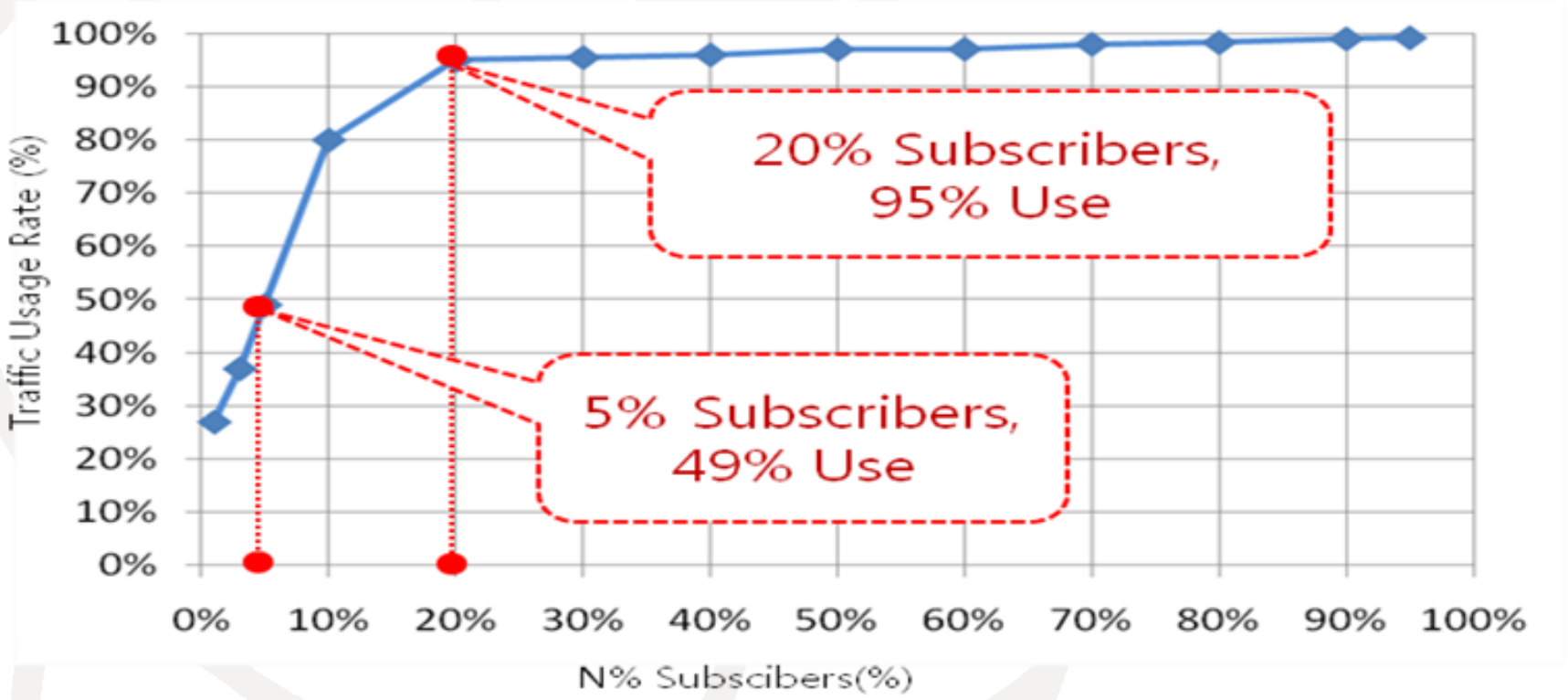
Relationship among NGN, SUN and FN in terms of context awareness



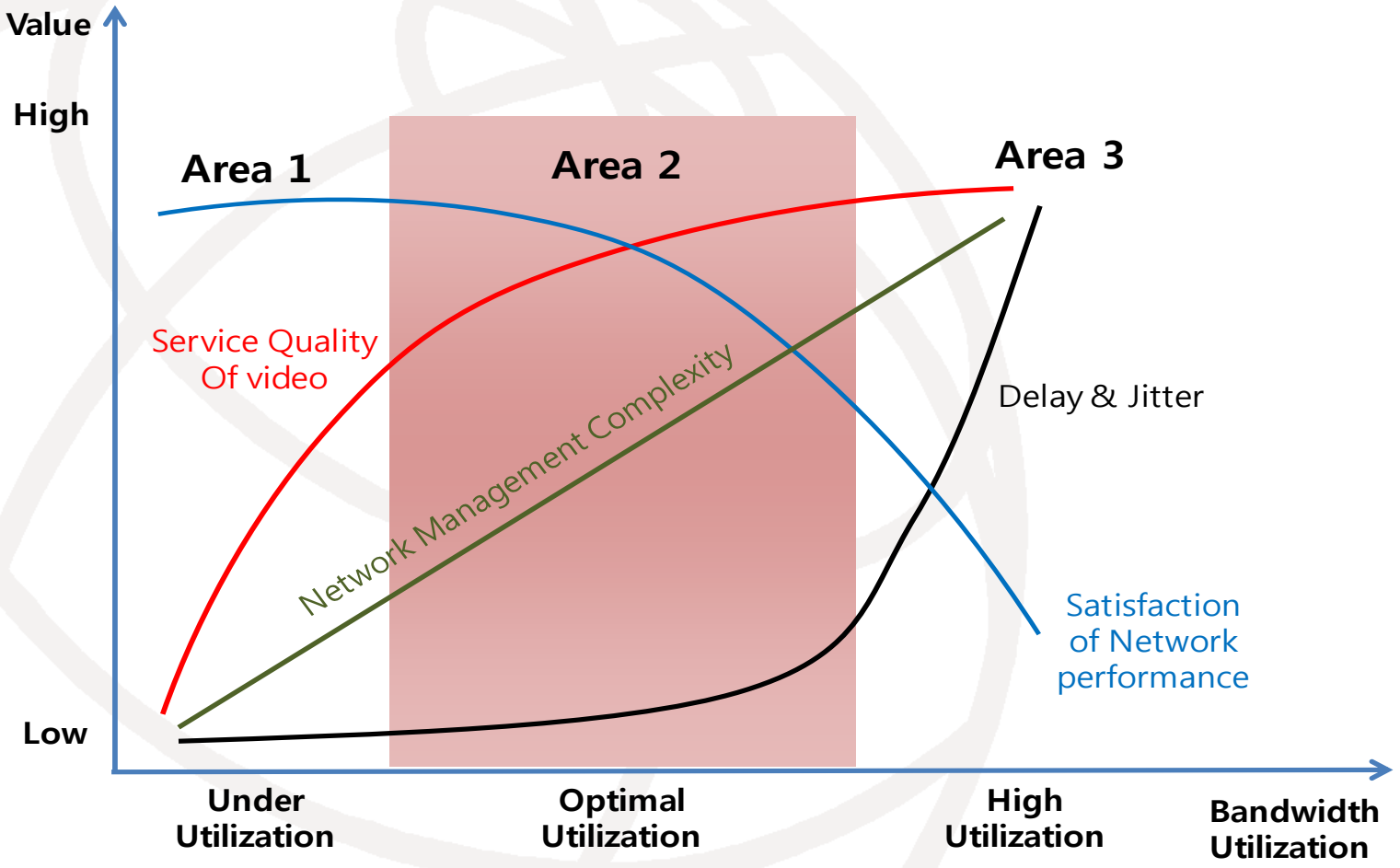
SUN - Smart Traffic Control and Resource Management

- This Recommendation
  - Specifies smart traffic control and resource management functions to provide fair usage of network resources using context awareness capability in SUN.
- This document covers the following
  - Motivation and objectives of smart traffic control and resource management
  - Requirements for smart traffic control and resource management for SUN
  - High level architecture and functional architecture
  - Control and management mechanisms

Monopolization of traffics in fixed network, 2010



Three different area of network operation



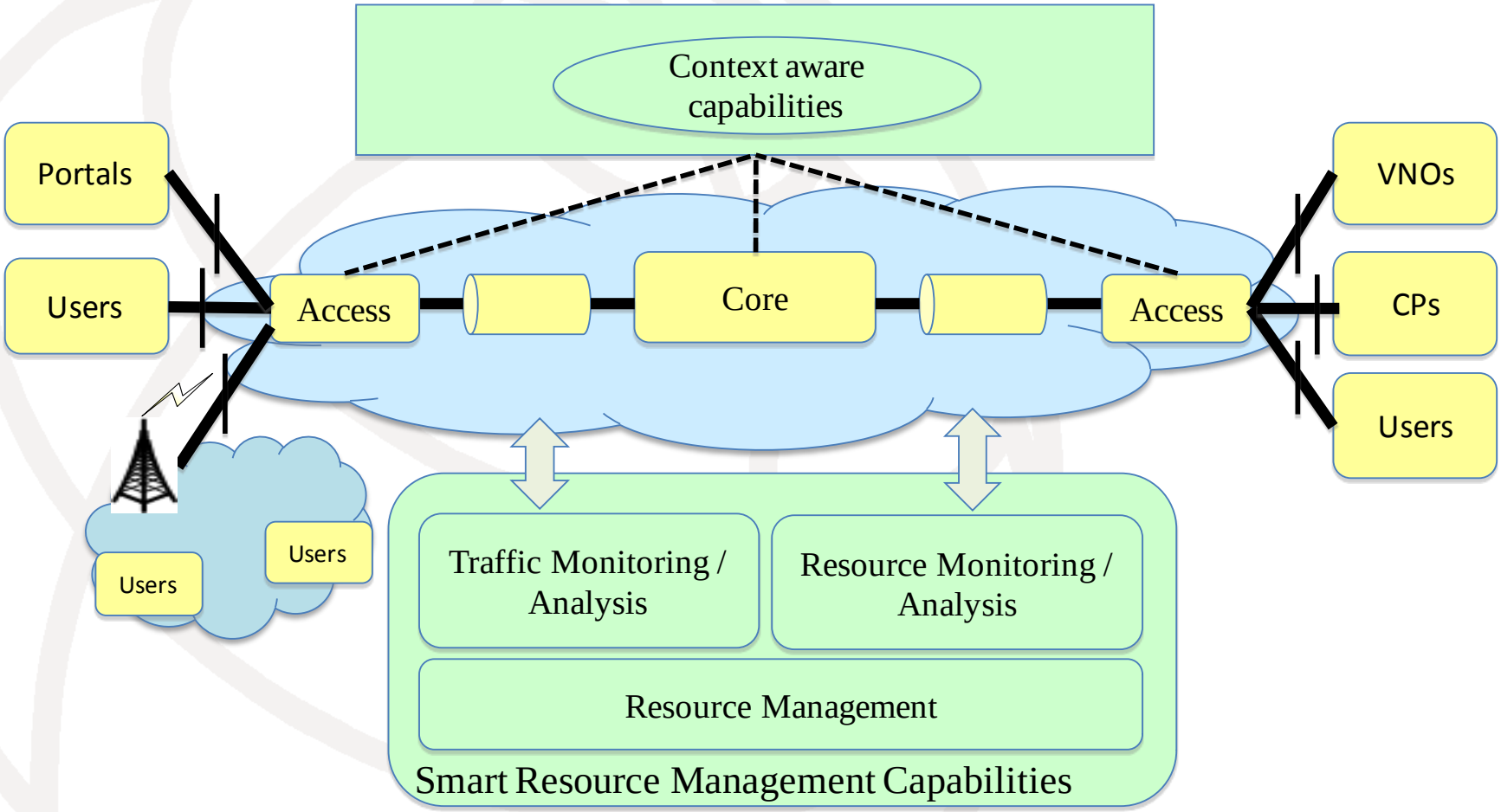
Fine-grained classifications of traffic

		Service Duration				
		Type 0 (less than 1 second)	**Type 1** (1 second - less than 10 minutes)	**Type 2** (10 minutes – less than 30 minutes)	**Type 3** (30 minutes - less than 1 hour)	**Type 4** (over 1 hour)
Bandwidth	**Type 0** (up to 1 kb/s)	Simple sensor data	Sensor data	NYI	NYI	NYI
	Type 1 (1 - 128 kb/s)	Text (SMS) Complicated sensor data	MMS Voice phone/ messaging	Voice Phone	Voice Phone Voice conferenc e	Voice Conference
	Type 2 (128 kb/s - 2 Mb/s)	NYI	Low-Q Video messaging & video clip HQ music	Low-Q Video phon e/conferen. Inter-mediate size file transfer	P2P download Web TV Web casting	P2P download Web TV/casting Tele-Video-Surv eillance
	Type 3 (2 - 20 Mb/s)	NYI	HD Video mes saging & vide o clip	HD Video Phone & conference Big size file transfer	IPTV(Drama) P2P Download Network game Video confer. E-Health appl.	IPTV (Movie) P2P Download Network game Video conf. E-Health appl.
	Type 4 (bigger than 20 Mb/s)	NYI	3D-Video messaging	3D-based Web con tents	3D TV 3D-Telepresen. Nuclear Researc h appl.	E-Health appl. Nuclear Researc h appl.

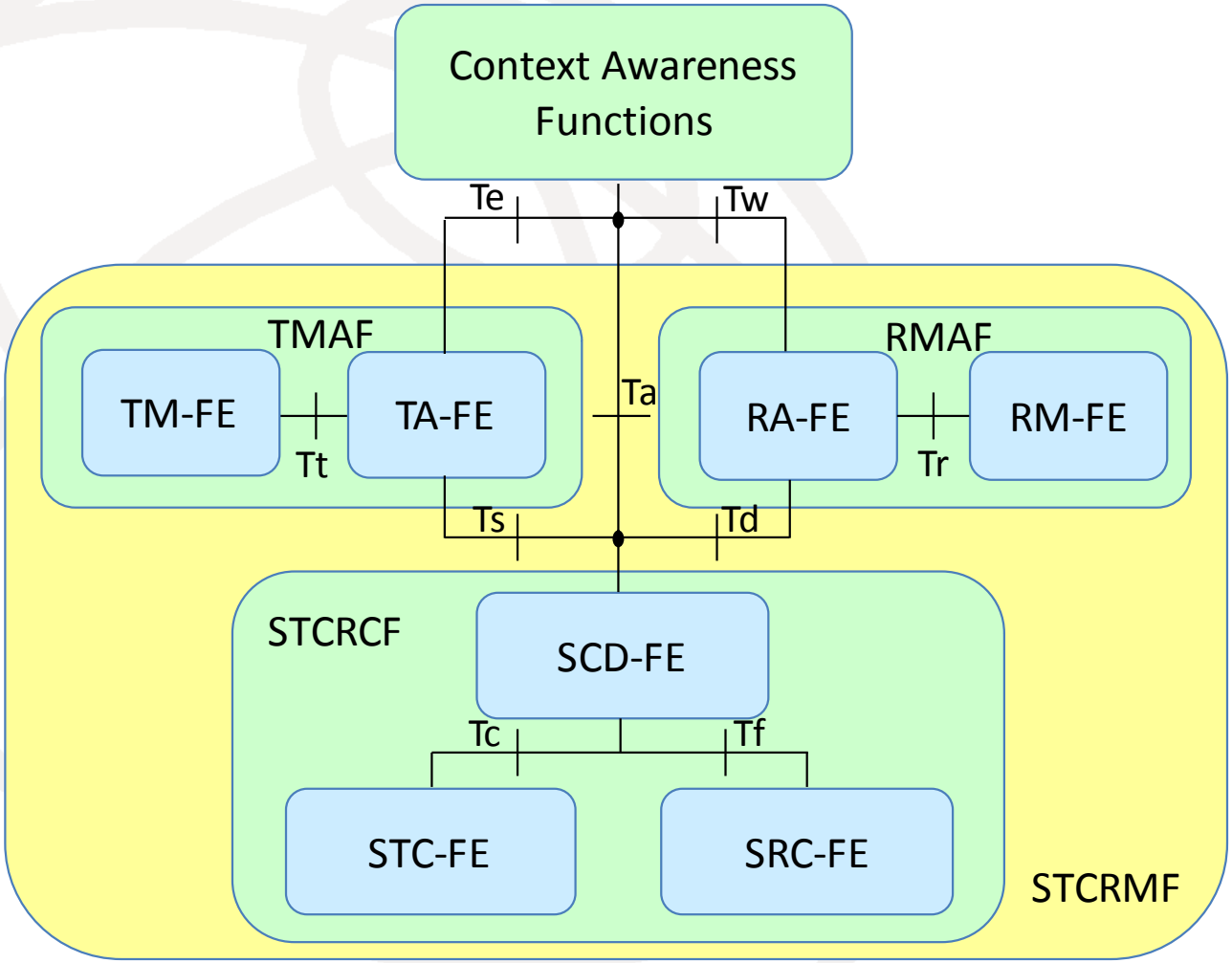
NYI: Not Yet Identified

Class 0 | Class 1 | Class 2 | Class 3

High level architecture of STCRMF



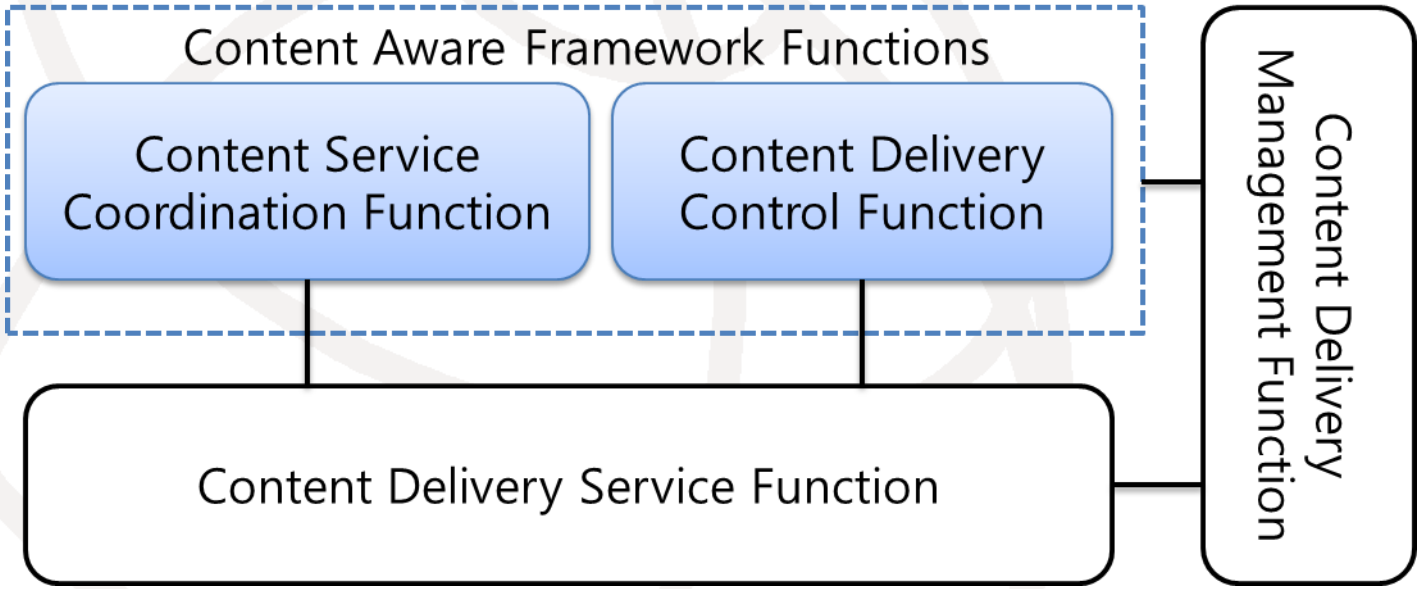
Functional architecture of STCRMF



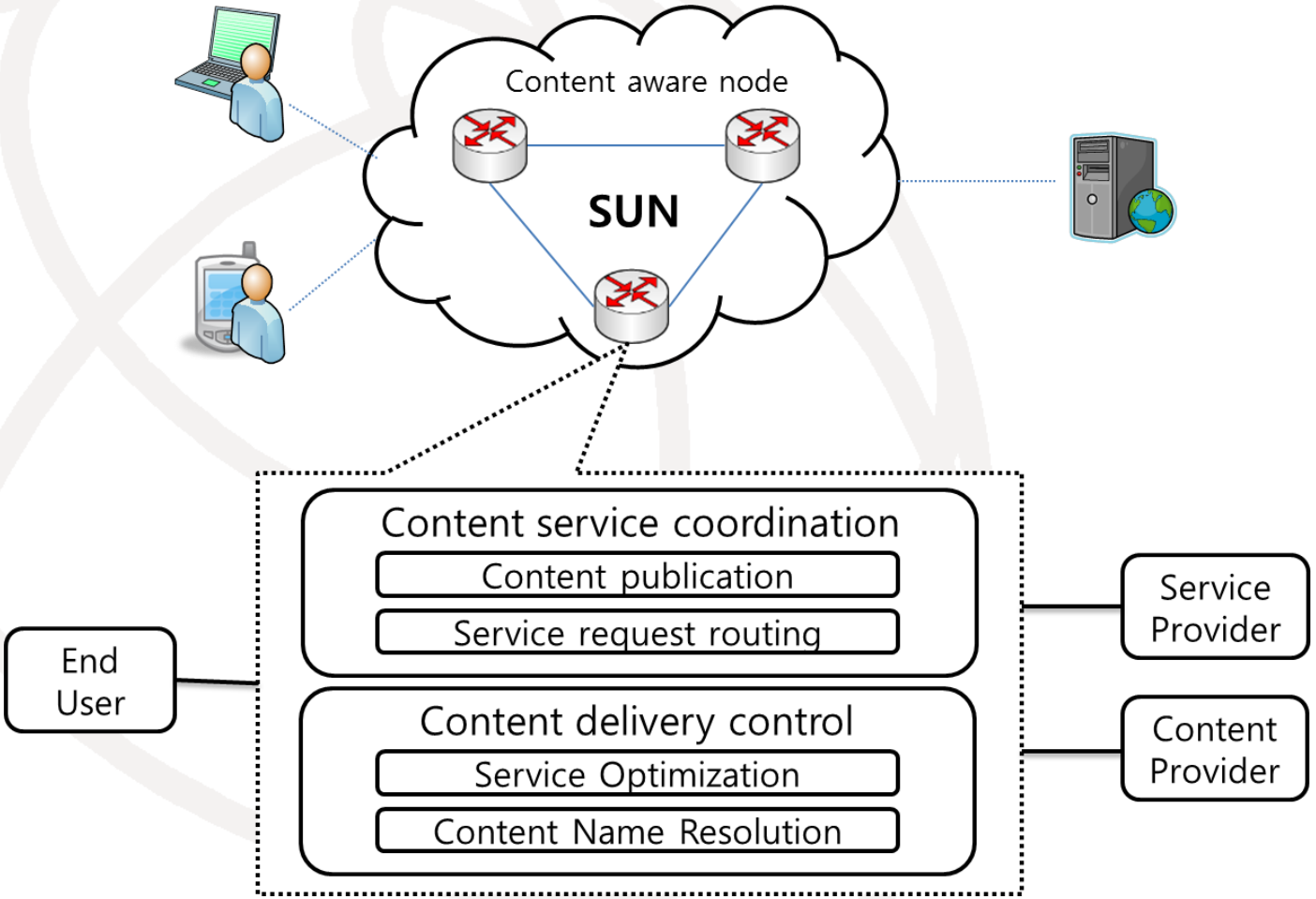
SUN – Content Awareness

- Content awareness
  - A key feature of SUN to support an optimized content delivery service.
  - an ability to identify, retrieve and deliver contents efficiently based on the content-related information considering location and/or user.
- SUN capabilities for content awareness
  - Content discovery
  - Content caching
  - Content distribution

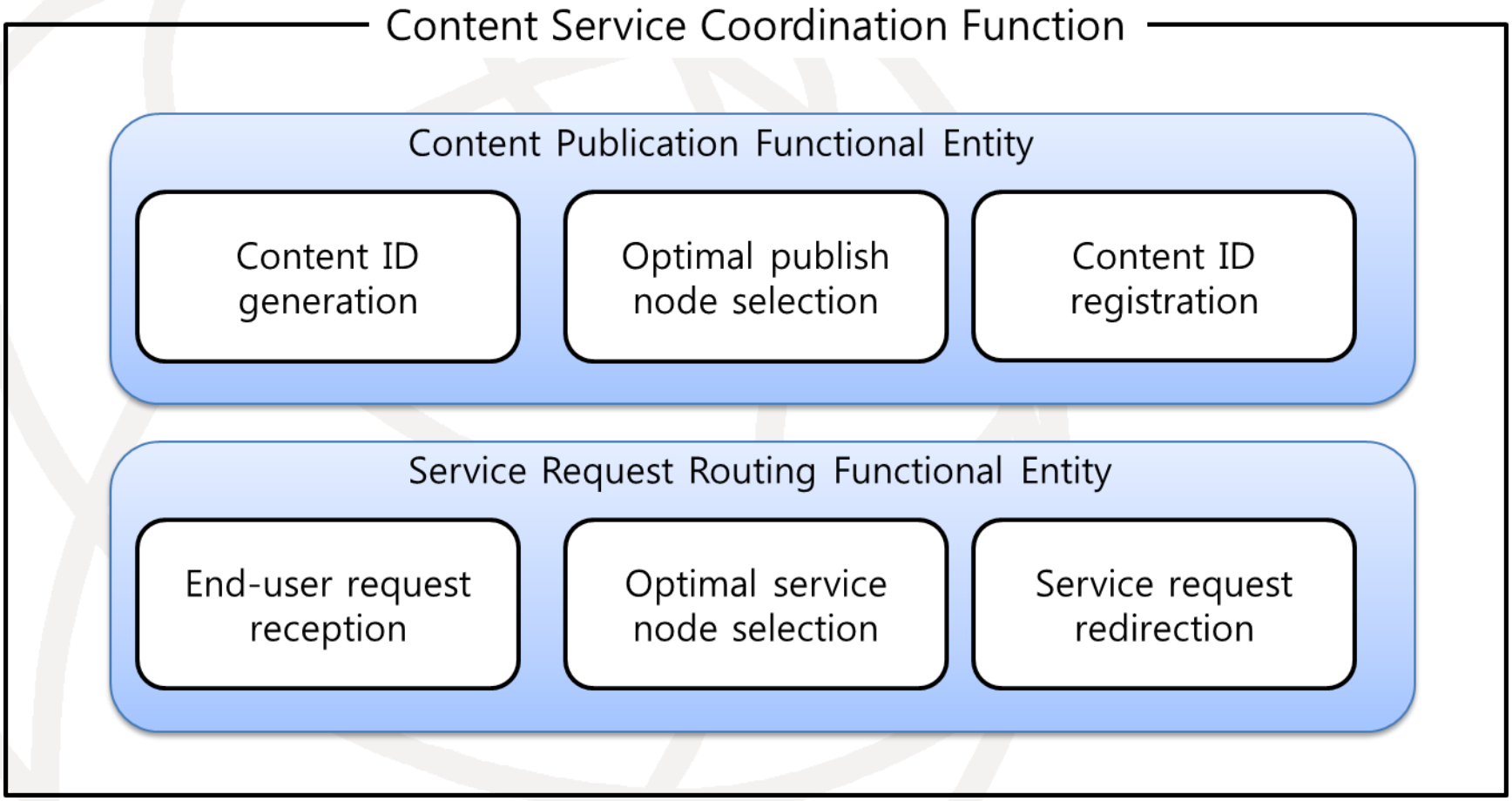
Functional model for content awareness in SUN



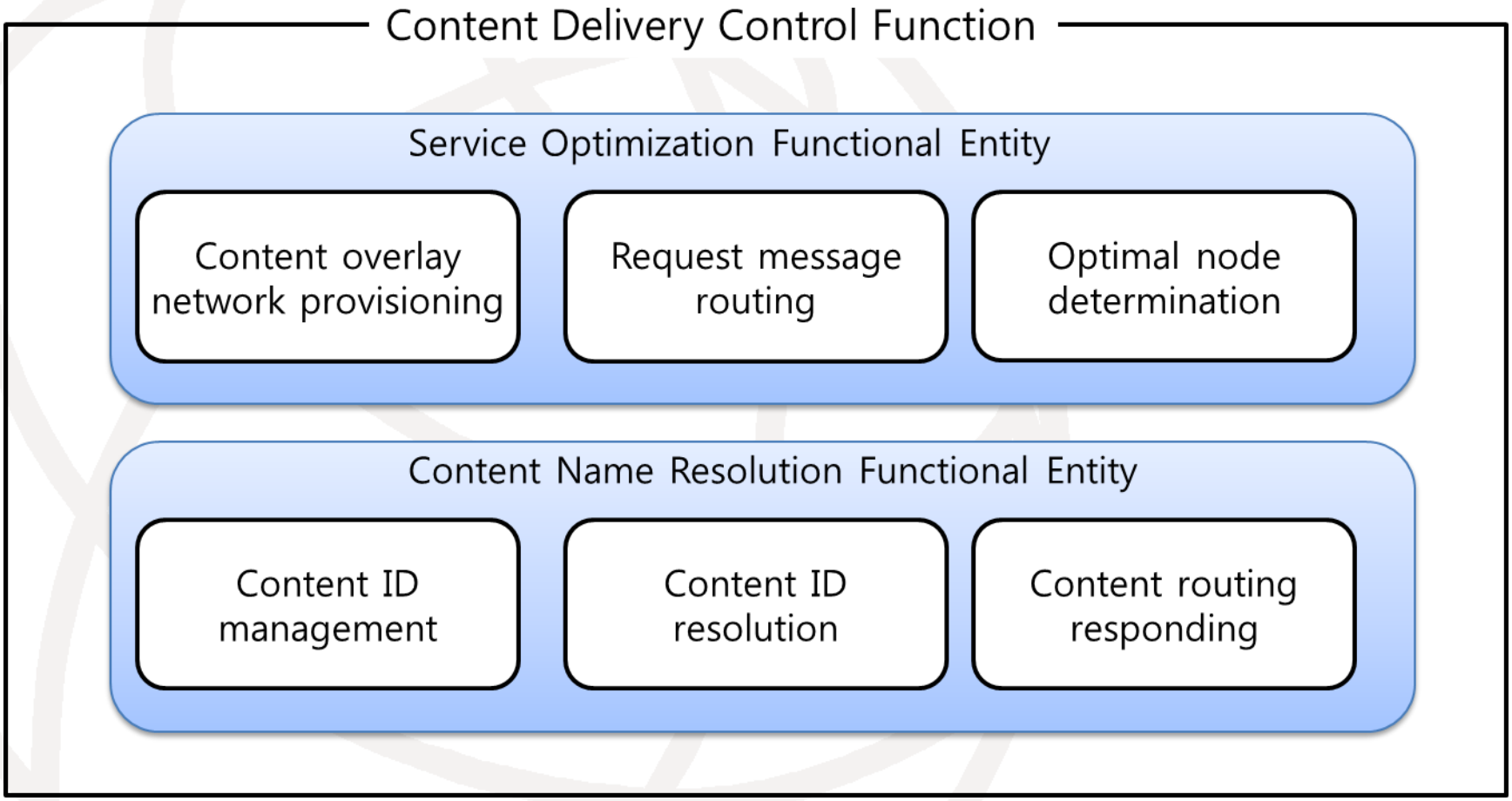
Content-Aware Framework Functions



Structure of Content Service Coordination Function



Structure of Content Delivery Control Function



Concluding Remarks

- Key objectives of SUN are to bring smart capabilities into the telecommunication networks.
  - especially addressing the support of context aware networking
- Thus future work for SUN should focus on an early realization and deployment with feasible technologies.

Q&A