IEEE P1903 (NGSON) WG Workshop

- **Introduction to P1903 WG**
  - **Prof. Mehmet, Chair, P1903 WG**
- **Use Case Scenarios**
  - **Chen Shan, Huawei**
- **Overview of NGSON Standards**
  - **Niranth, Huawei**
  - **Jong-Hwa Yi, ETRI**
  - **Seung-Ik Lee, ETRI**
  - **Fuchun Joe Lin, NCTU**

**(June-2013/IEEE/Workshop)
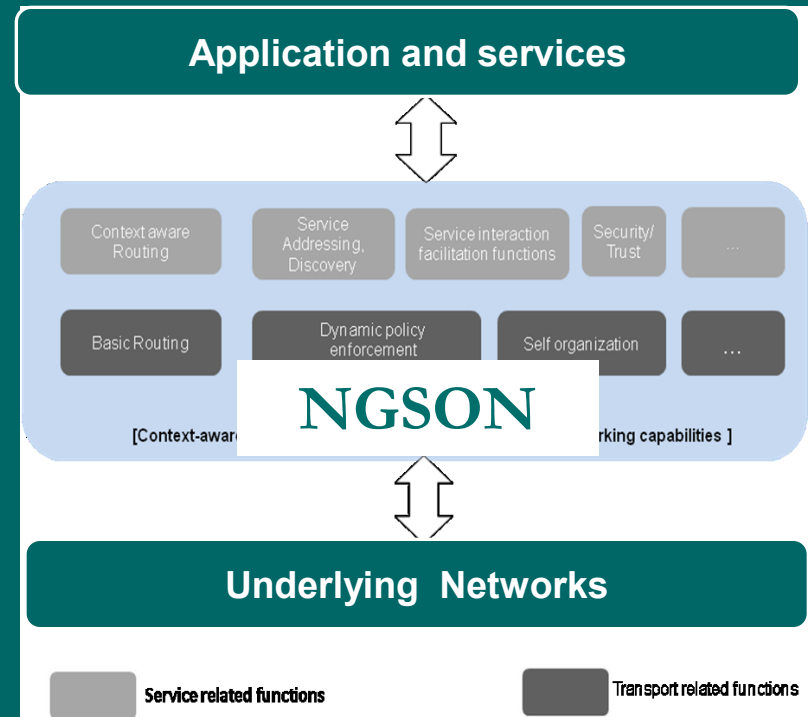Budapest, Hungary**

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IEEE P1903 NGSON

NEXT GENERATION SERVICE OVERLAY NETWORKS

NGSON WEBINAR
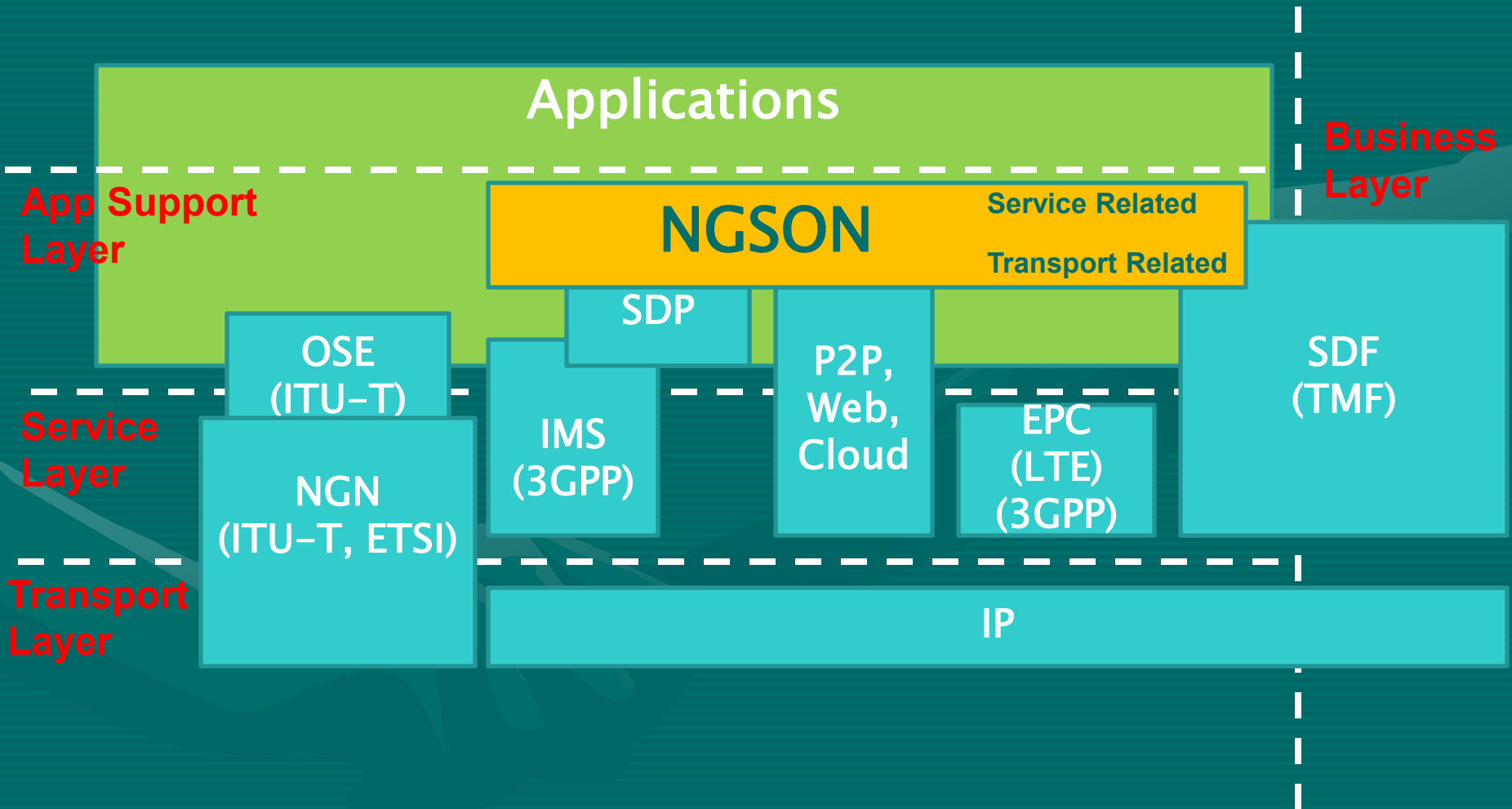
Budapest Workshop

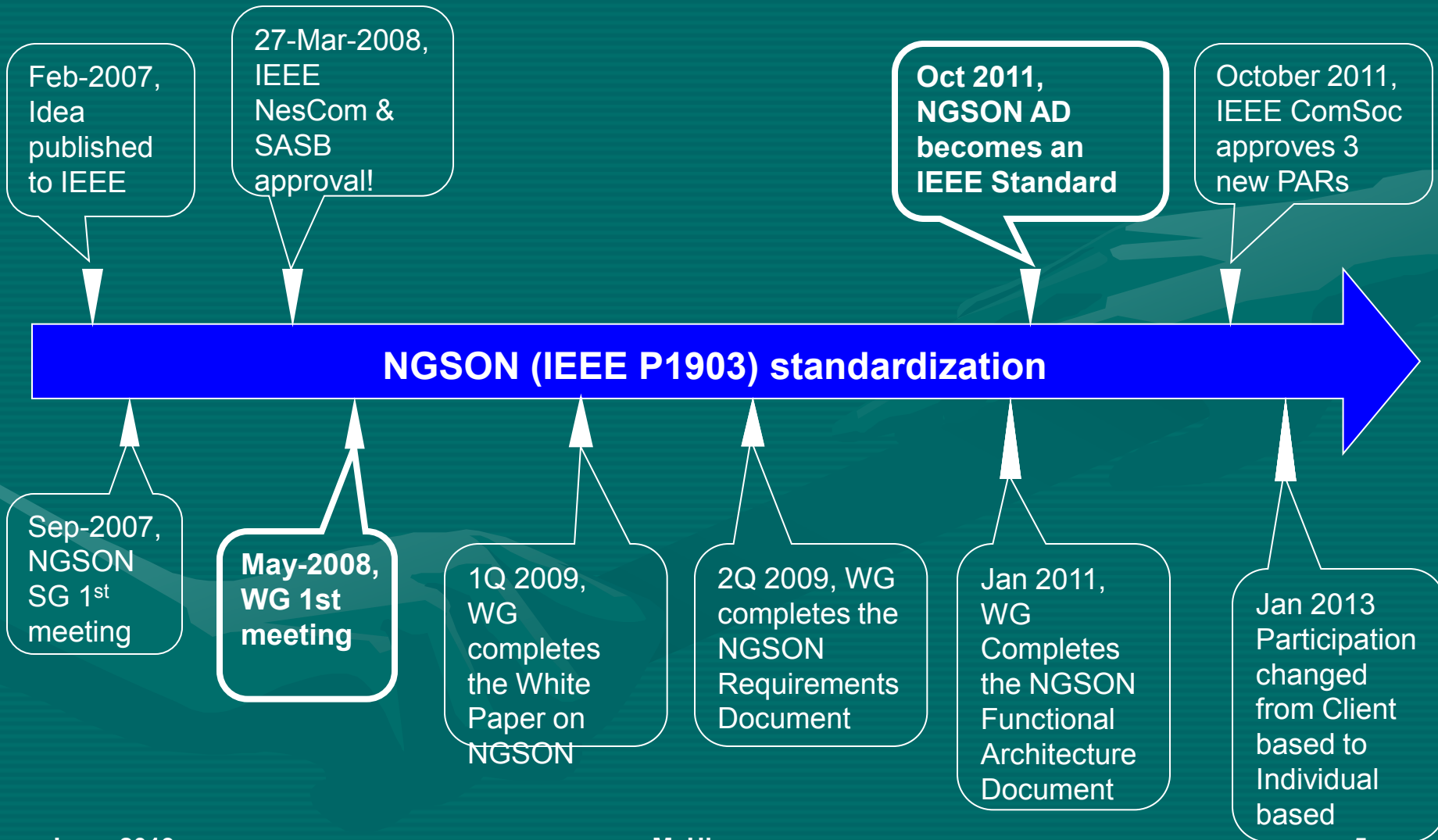### June 2013

What is NGSON

- **An IEEE sponsored effort to standardize a framework of IP-based service overlay networks**

- **A set of context-aware, dynamically adaptive, and self-organizing networking capabilities, including advanced routing and forwarding schemes**

Application and services

Context aware Routing | Service Addressing, Discovery | Service interaction facilitation functions | Security/ Trust | ...

Basic Routing | Dynamic policy enforcement | Self organization | ...

NGSON

[Context-aware ... rking capabilities]

Underlying Networks

Service related functions

Transport related functions

Position of NGSON Standards

IEEE P1903 NGSON

Feb-2007, Idea published to IEEE

27-Mar-2008, IEEE NesCom & SASB approval!

Oct 2011, NGSON AD becomes an IEEE Standard

October 2011, IEEE ComSoc approves 3 new PARs

NGSON (IEEE P1903) standardization

Sep-2007, NGSON SG 1st meeting

May-2008, WG 1st meeting

1Q 2009, WG completes the White Paper on NGSON

2Q 2009, WG completes the NGSON Requirements Document

Jan 2011, WG Completes the NGSON Functional Architecture Document

Jan 2013 Participation changed from Client based to Individual based

Document Status

- White Paper   Released   1Q09
- Requirements   Frozen   2Q09
- Architecture   Standardized   3Q11
- Technical Specs   Started   3Q11

New PARs Approved by IEEE

- **Content Delivery (P1903-1)**
  - **Technical Standard for Content Delivery Protocols of NGSON**

- **Service Composition (P1903-2)**
  - **Technical Standard for Service Composition Protocols of NGSON**

- **Self-Organizing Management (P1903-3)**
  - **Technical Standard for Self-Organizing Management Protocols of NGSON**

Where to Find us?

- **Website:**
  - http://grouper.ieee.org/groups/ngson/index.html

- **For questions:**
  - Mehmet Ulema: mehmet.ulema@manhattan.edu
  - Niranth: namogh@huawei.com
  - Lisa Perry: L.Perry@ieee.org

IEEE NGSON
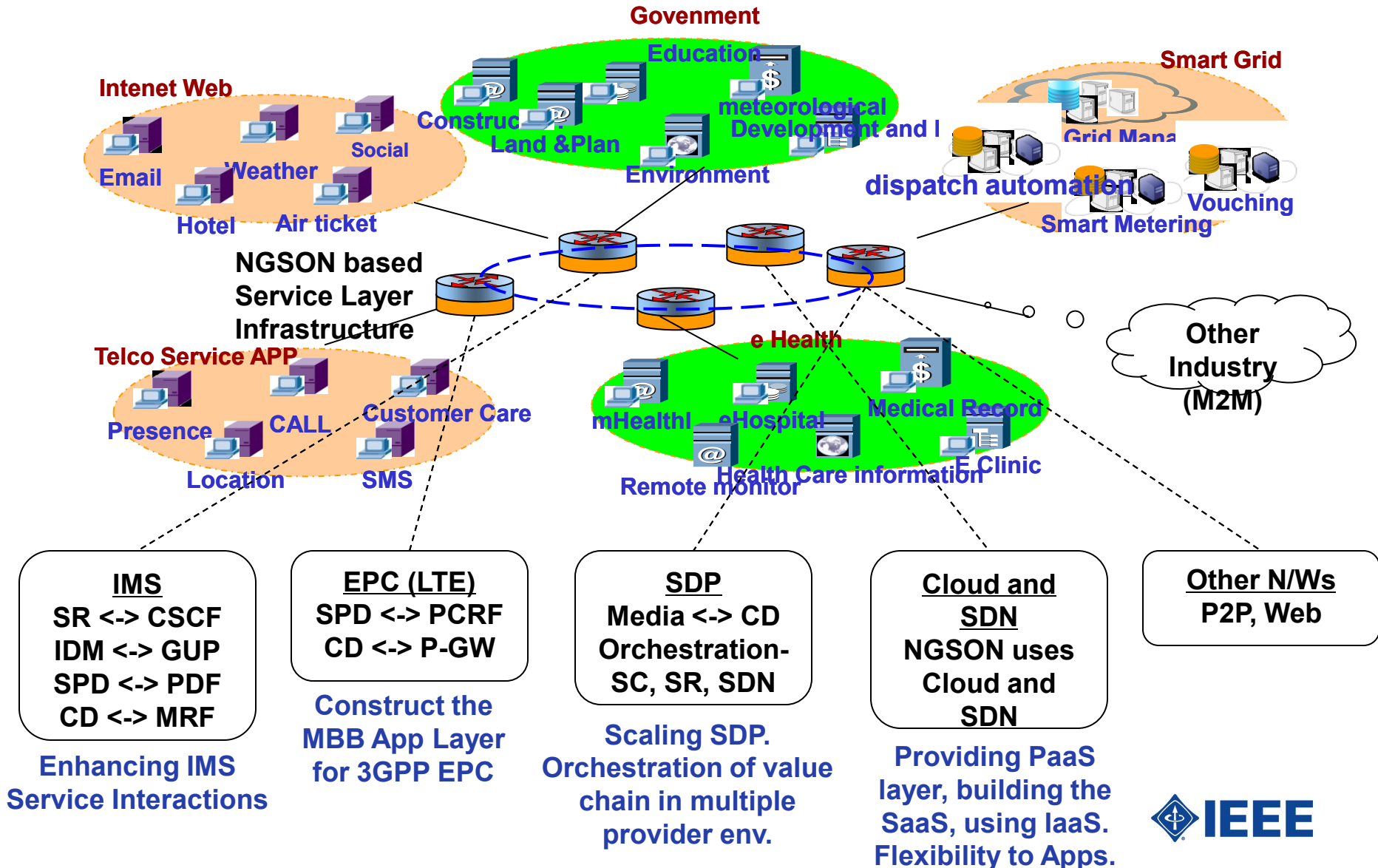# Use Case Scenarios

Chen Shan
Huawei

(June-2013/IEEE/Workshop)

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Agenda

- **NGSON enables Service Ecosystem**

- **E2E Use Case for NGSON**

- **Specific NGSON Scenarios**

NGSON enables Service Ecosystem

Govenment

Education

Construc...
Land &Plan

meteorological Development and I

Environment

Intenet Web

Email
Weather
Social
Hotel
Air ticket

Smart Grid

Grid Mana...

dispatch automation

Smart Metering

Vouching

NGSON based Service Layer Infrastructure

Other Industry (M2M)

Telco Service APP

Presence
CALL
Customer Care
Location
SMS

e Health

mHealthl
eHospital
Medical Record
Health Care information
E Clinic
Remote monitor

IMS	EPC (LTE)	SDP	Cloud and SDN	Other N/Ws
SR <-> CSCF IDM <-> GUP SPD <-> PDF CD <-> MRF	SPD <-> PCRF CD <-> P-GW	Media <-> CD Orchestration- SC, SR, SDN	NGSON uses Cloud and SDN	P2P, Web

Enhancing IMS Service Interactions

Construct the MBB App Layer for 3GPP EPC

Scaling SDP. Orchestration of value chain in multiple provider env.

Providing PaaS layer, building the SaaS, using IaaS. Flexibility to Apps.

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E2E Use Case for NGSON
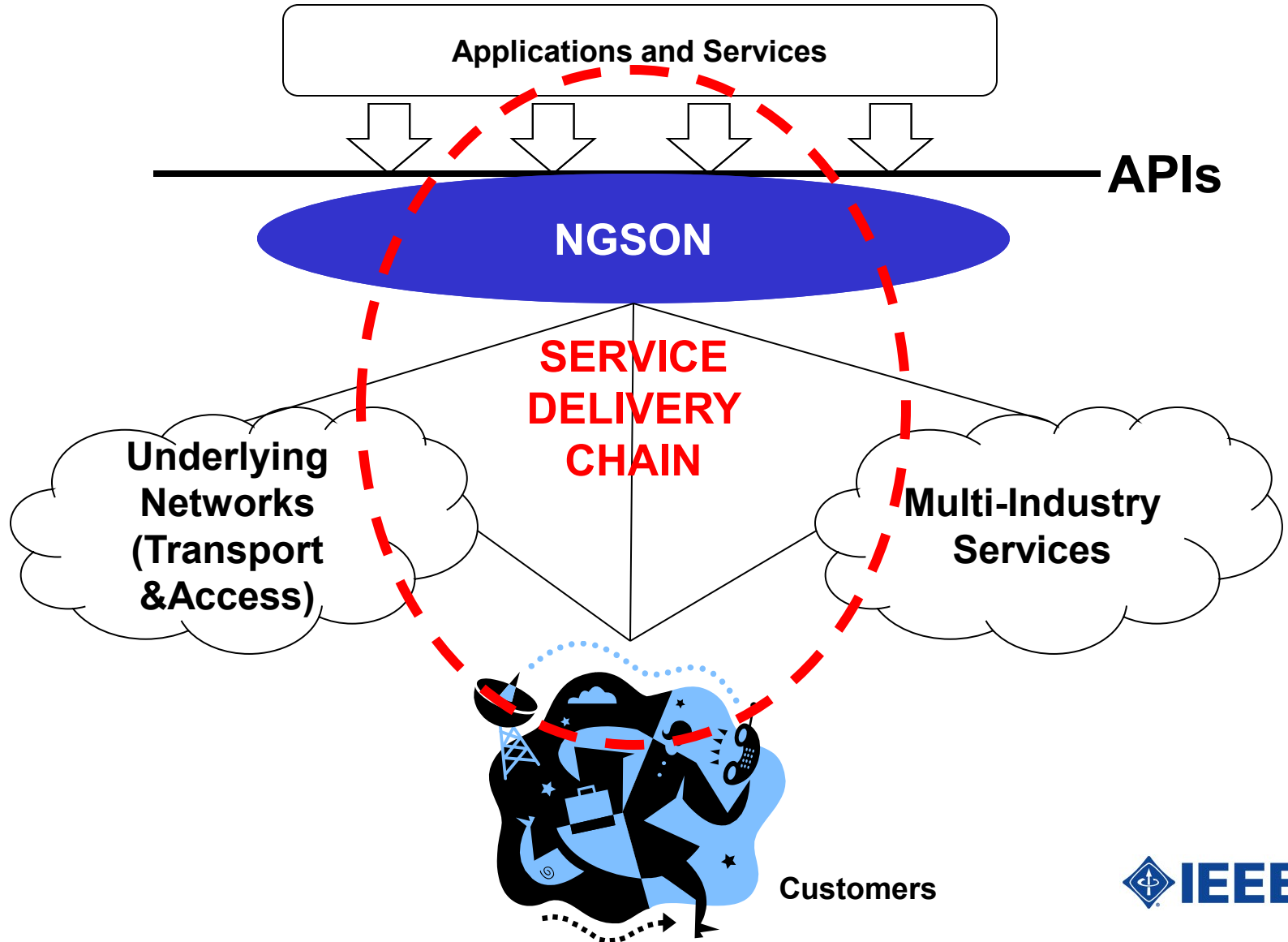
- **Step 1: NGSON makes all the Services and APIs available from various networks of a Service Provider and the Partners.**

- **Step 2: Compose a Service Chain (eg. Video content service) by Orchestrating the services, service functions and network functions using NGSON.**

- **Step 3: Deploy the Service Chain. NGSON understands the service chaining specification and initializes the related NGSON functions.**

- **Step 4: Service is provisioned to the End User for a certain instance type (Usually a factor of cost). NGSON prepares to execute the Service Chain for the particular instance type by issuing commands to functions of NGSON like:**

  - **Service Discovery: To discover the destination services appropriate for the Service Chain for the instance type.**

  - **Service Routing: To setup the routes of the Service Requests to appropriate destinations and support Self Organization in terms of Self-Optimization, Route re-configuration and Fault Recovery.**

  - **Content Delivery: To setup efficient content delivery for the service with the help of Context Information and Service Policy Decision functions of underlying networks like P2P, Cloud, CDN, SDN, etc.**

  - **Operation and Management: To automatically self-organize the NGSON Physical systems to realize the Service Chain. (Manage the OPEX)**

- **Step 5: NGSON provides high QoE Service Delivery considering the dynamic situations of the User, Network, Service and Device. Also providing flexible charging options.**
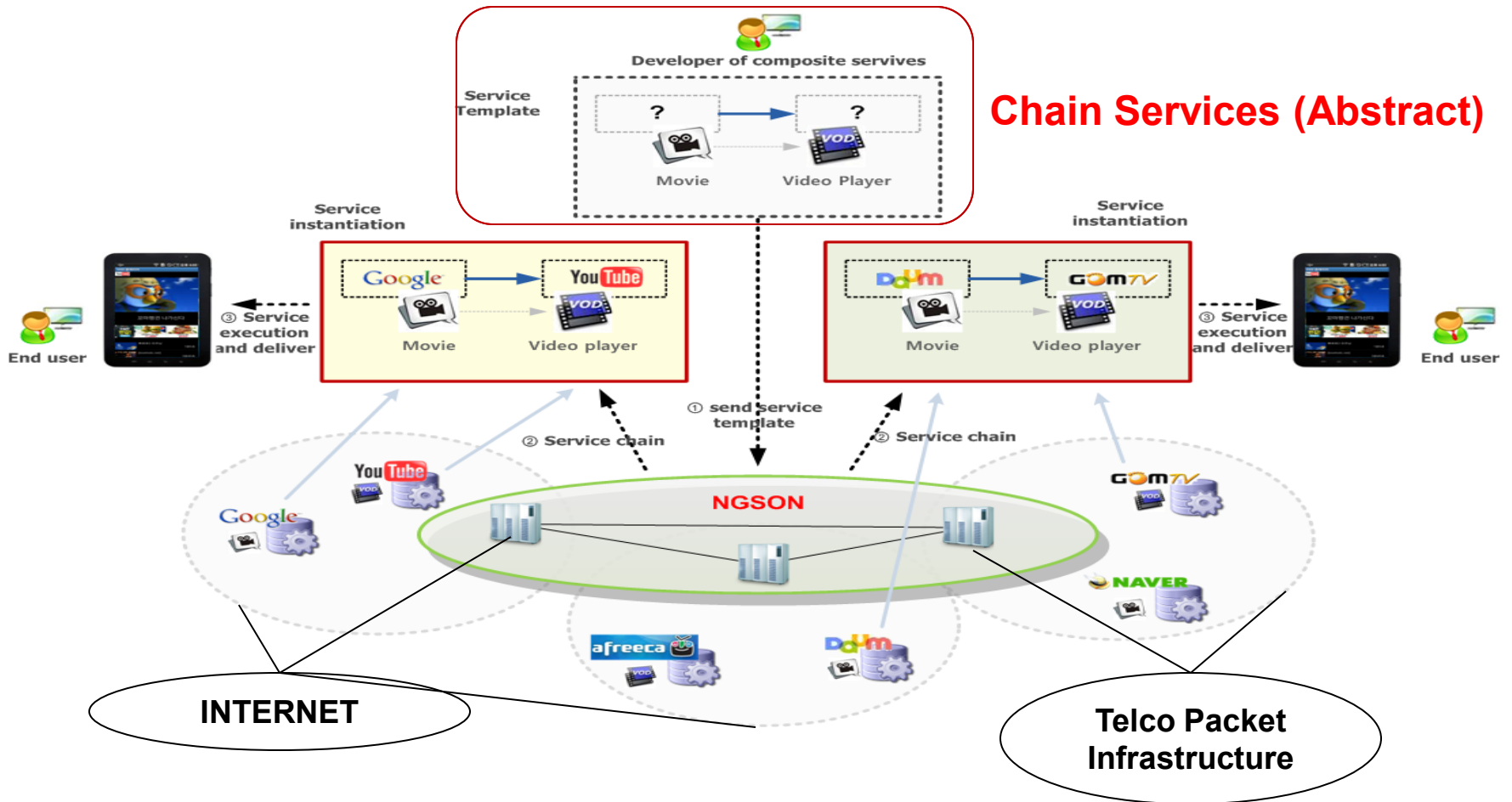
Examples for NGSON Service are:
•Bandwidth Service (User selected services + Charging Plans)
•Mashup Service (Internet Content + Telco Service)

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Open APIs

Applications and Services

APIs

NGSON

SERVICE DELIVERY CHAIN

Underlying Networks (Transport &Access)

Multi-Industry Services

Customers

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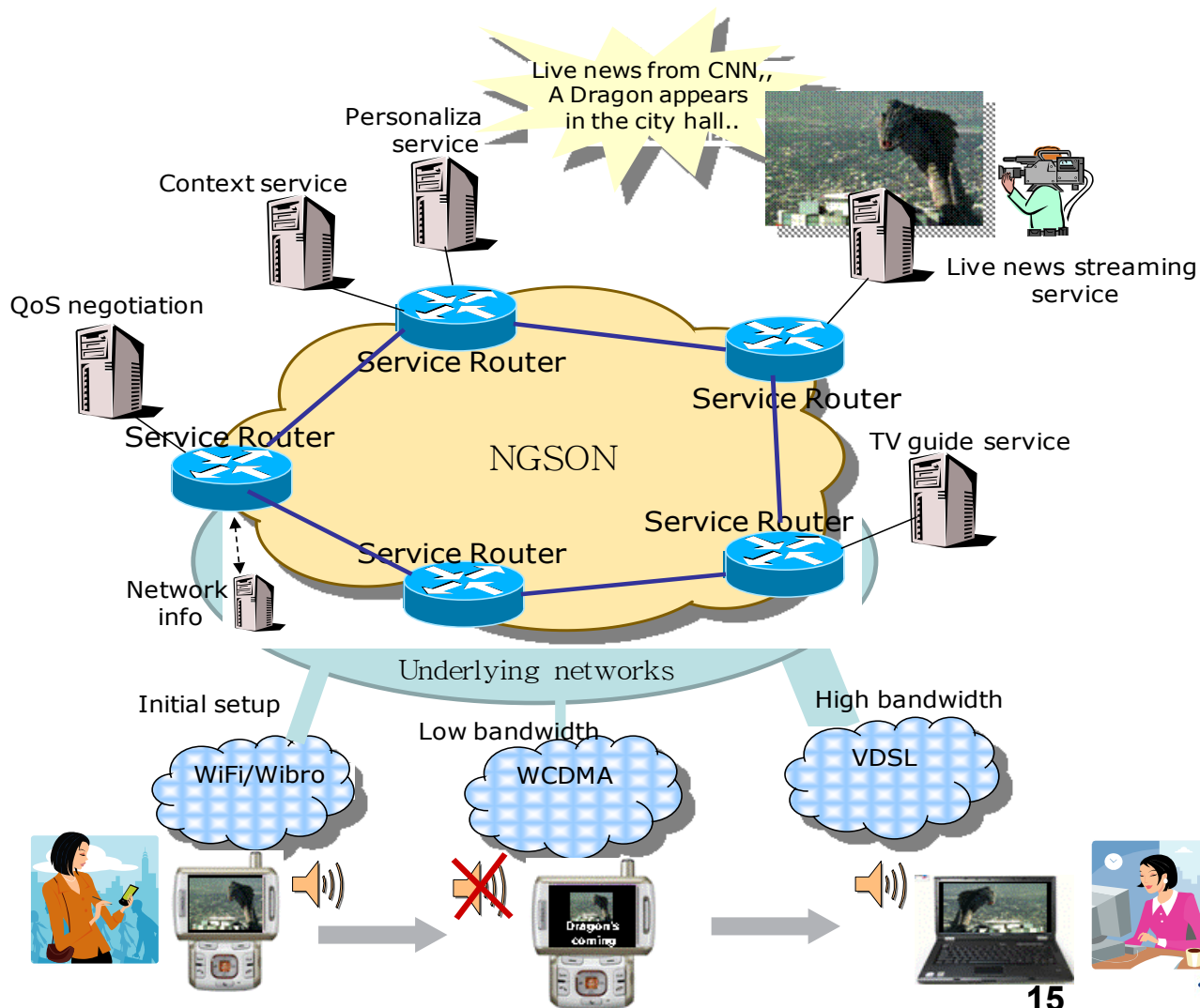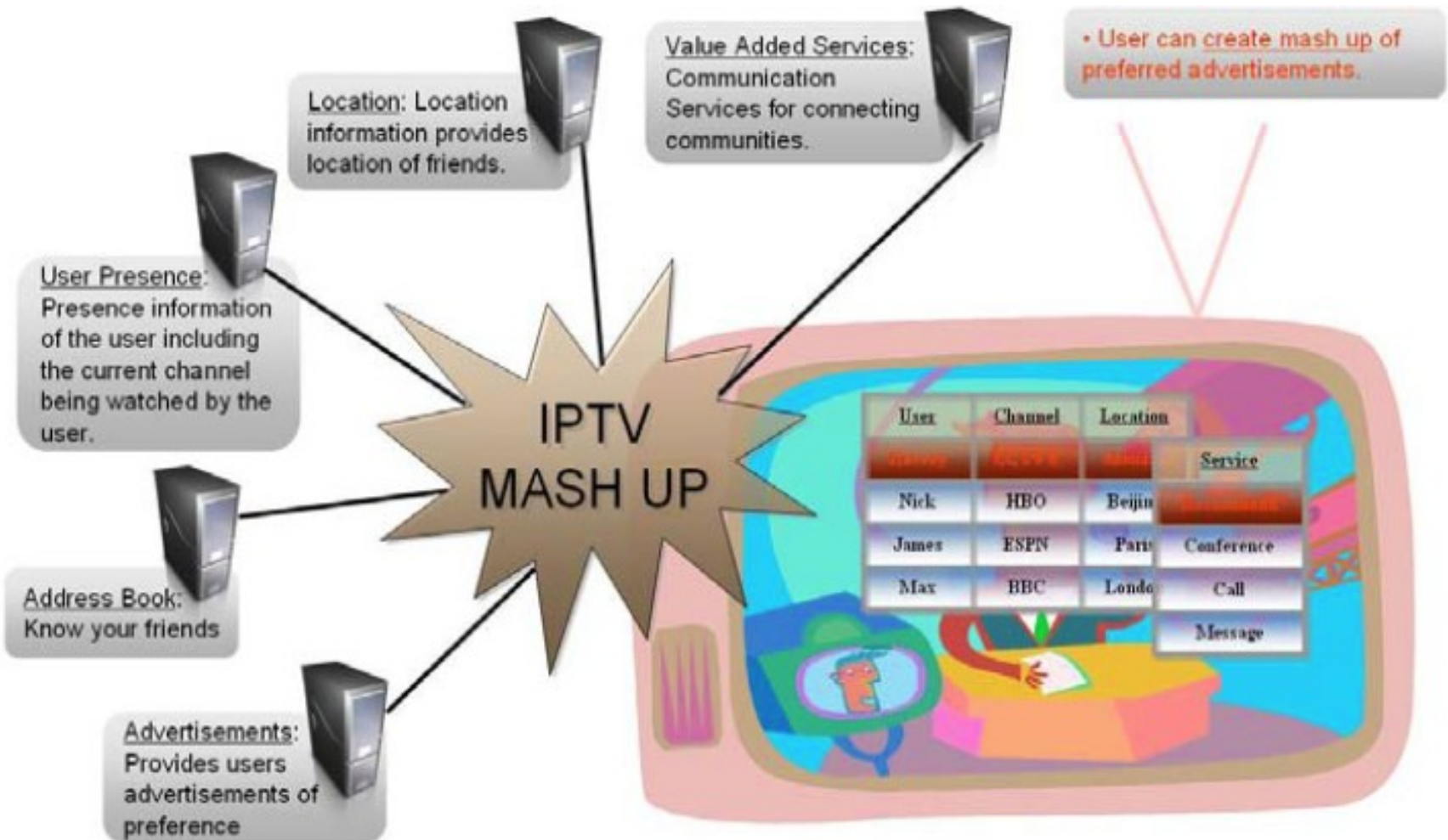# Service Abstraction

Chain Services (Abstract)

Instantiate over different services & networks (SDN, etc) with Differentiated Experience and Cost
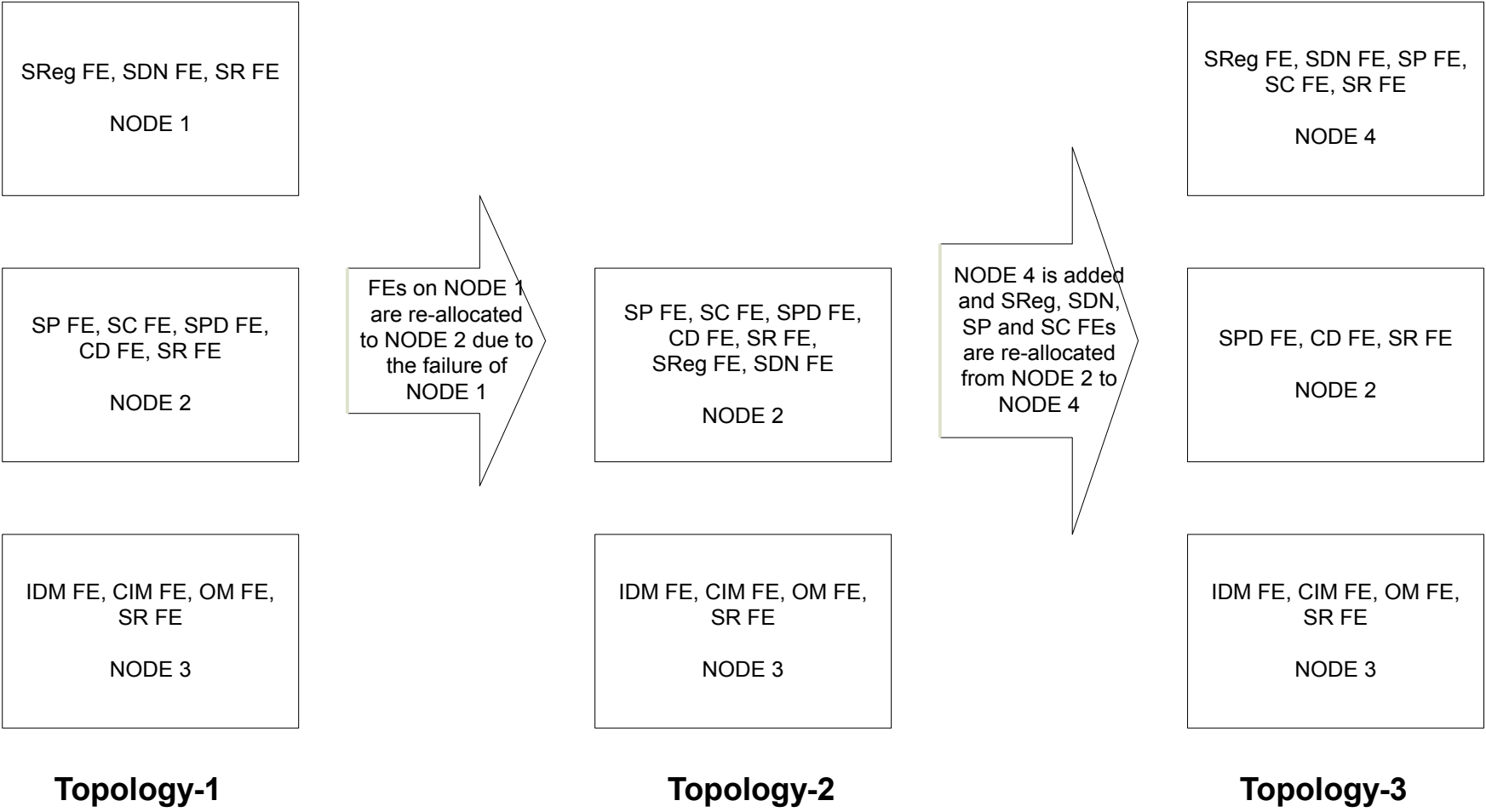
Dynamic Service Composition & Adaptation

Service Delivery Orchestration

Self Organization

SReg FE, SDN FE, SR FE

NODE 1

SP FE, SC FE, SPD FE,
CD FE, SR FE

NODE 2

IDM FE, CIM FE, OM FE,
SR FE

NODE 3

FEs on NODE 1
are re-allocated
to NODE 2 due to
the failure of
NODE 1

SP FE, SC FE, SPD FE,
CD FE, SR FE,
SReg FE, SDN FE

NODE 2

IDM FE, CIM FE, OM FE,
SR FE

NODE 3

NODE 4 is added
and SReg, SDN,
SP and SC FEs
are re-allocated
from NODE 2 to
NODE 4

SReg FE, SDN FE, SP FE,
SC FE, SR FE

NODE 4

SPD FE, CD FE, SR FE

NODE 2

IDM FE, CIM FE, OM FE,
SR FE

NODE 3

Topology-1

Topology-2

Topology-3

Thank you!

Contact: chenshan@huawei.com

Overview of the IEEE P1903 (NGSON) Standards

Niranth - Project Officer, P1903 WG, Huawei
Seung-Ik Lee - Editor, P1903.1 Spec, ETRI
Jong-Hwa Yi - Editor, P1903.2 Spec, ETRI
Fuchun Joe Lin - Editor, P1903.3 Spec, NCTU
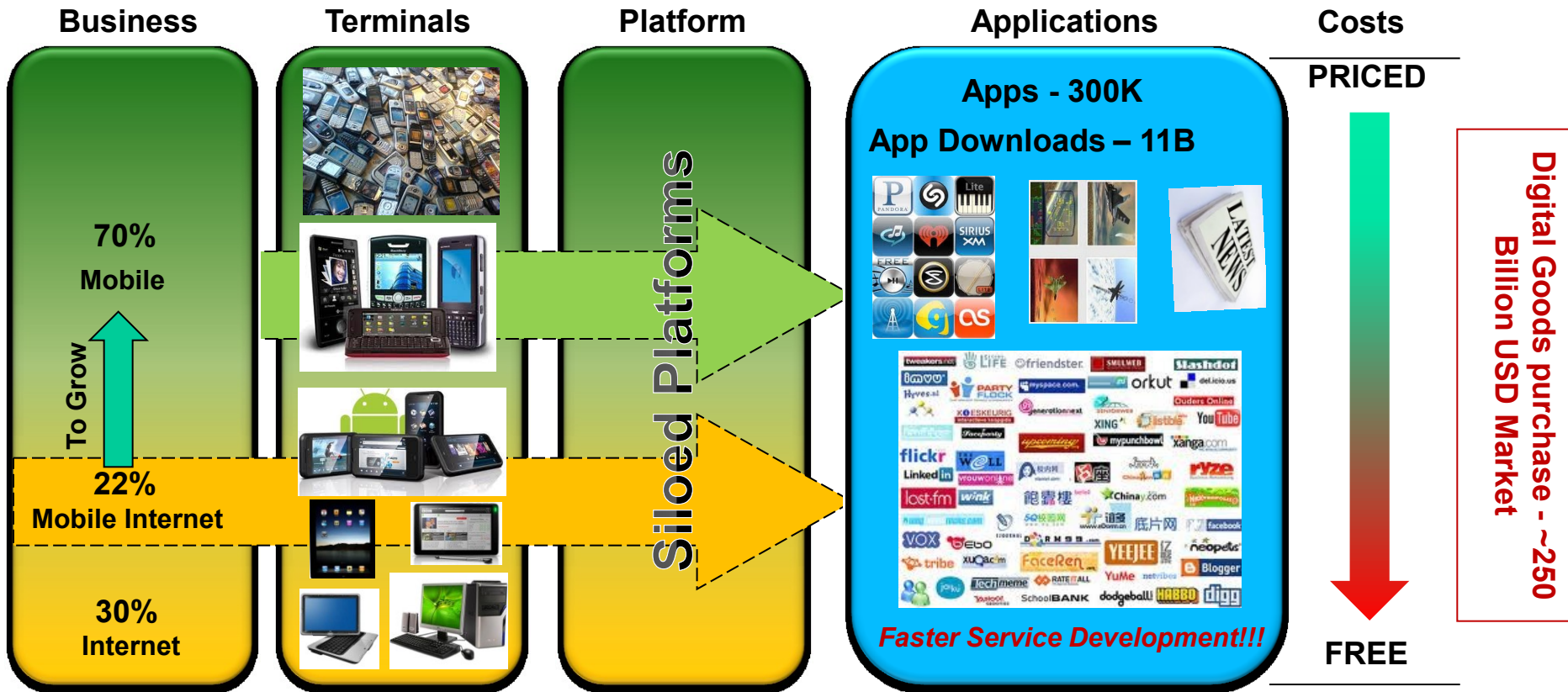
(11 Jun-2013/IEEE/Workshop)
Budapest, Hungary

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Agenda

- **Background**

- **Introduction to NGSON Architecture**

- **Current Standards Specification**

Current Challenges

Network Operators	Bandwidth requirement exploding	ARPU decreased, revenue eroded
	Internet services – good QoE	Minor income with heavy burden
	Voice is still major income source	Challenged by VoIP with zero price
	Data services increasing dramatically	Price competition will come soon
Service & Content providers	Major income from advertisement	No such thing called ARPU
	Internet services are popular	User activities are anonymous, hard to locate target customers proactively
Vertical Industries & Companies	Internet portal becomes necessity	How about mission critical business?
End Users	I love Internet !!!	Sometimes QoS is a problem It's dangerous if you are exposed
	Services and Advertisements are everywhere	Becoming spam, but still hard to find out critical services in time
	Telecom services are stable	Limited services, not attractive at all Too stiff, not adaptive

Opportunities

Business	Terminals	Platform	Applications	Costs

PRICED

Apps - 300K

App Downloads – 11B

70%

Mobile

To Grow

22%

Mobile Internet

30%

Internet

Siloed Platforms

Faster Service Development!!!

FREE

Digital Goods purchase - ~250 Billion USD Market

Mobile Internet is challenging operators profitability and they need to think about transforming their networks and business model in the next 3 years (Developing country operators need to take important decision by Q3 2014. Business cannot be sustained by simply increasing the capacity or "dumb pipes") – TellLabs Study

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Use Cases

- **Automated adaptation of Service Characteristics during (Multimedia – Video, Voice, Text) Service Delivery based on Contexts (Current Device Type, Mobility, Available bandwidth, Content Popularity, etc.)**

- **User centered Service Composition to create context aware and personalized services. Eg. Personalized Tour service, Content recommendation service, etc.**

- **Service Orchestration of the Service Delivery value chain by combining services from different industries (Web, Energy, Telco, Health, Governance)**

- **Self Organization of the Core Network and Application Layer to achieve OPEX optimization - adjusting the structure and functions of NGSON**

- **Opening APIs to Applications for Service Layer Operations thus allowing programmability of Service Delivery.**

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NGSON Requirements

NGSON Requirements

Common

Addressing

Interaction

Interworking

Cross-layer

ID Management

QoS

Security

Service framework to 3rd party providers

Infrastructure virtualization

Global ID

Service

Service routing
Service registration
Service Discovery and Publication
Negotiation
Service Composition
Charging
Seamless Mobility
Context Awareness
Service related Self Organization
Brokering
Service Co-ordination
Service Collaboration
Virtualization
Messaging for O&M through Service Routing
Service related P2P Overlay
Service replication
Community based services

Delivery

Network Routing
Transport Related Functions
Self Organization Adaption
Identity
Resource Virtualization
Network Composition
Resource Scheduling
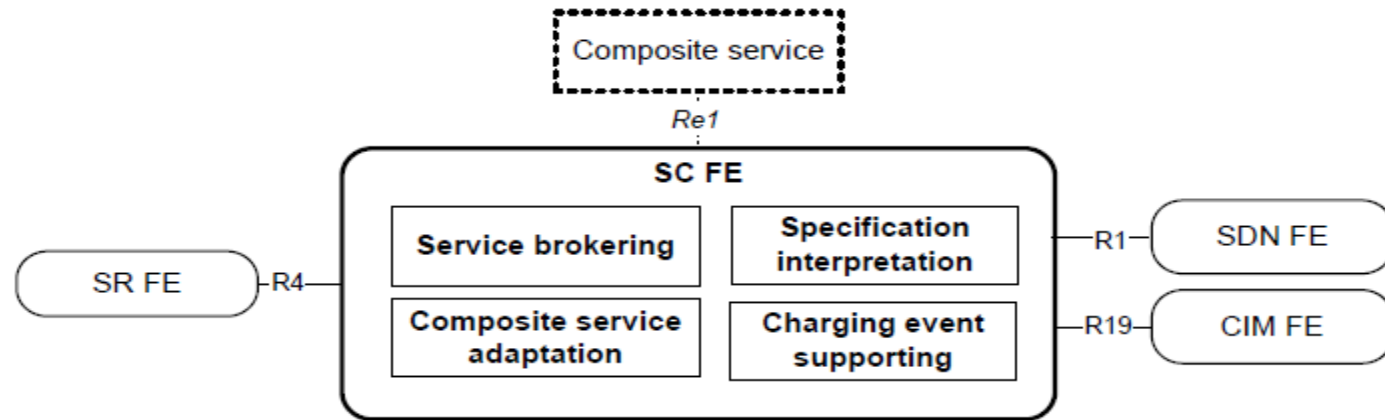**Network Traffic Optimization**
Transport related P2P Overlay

O&M

Manageability
FCAPS
Lifecycle management
Service arrangements and provisioning between providers

IEEE NGSON Architecture

Applications and services
- Service
- Composite Service

R_e1

Discovery & Negotiation supporting Composition & Routing functions

R_e2

Service & Transport related Functions

- Service Composition FE — R_19
- R_1
- R_7
- R_4
- R_5
- Service Discovery and Negotiation FE
- R_3
- R_6 — Service Register FE
- R_16
- R_2
- R_18
- Service Routing FE
- Overlay Management FE
- End User Functions
- R_17
- Service Portal FE — R_15
- R_13
- NGSON
- Identity Management FE
- R_9
- R_12 — Context Information Management FE
- R_8
- R_14
- R_10
- R_11
- Content Delivery FE
- Service Policy Decision FE
- R_20

O&M Functions

R_e3

R_e4

Static & Dynamic Service Chaining and Instantiation

Maintenance of Service Dynamic Information

Self Organization of NGSON structure and functions.

Service interaction and Service forwarding techniques

Allows user access to NGSON services

Service, Network, Device, User contexts mgmt.

User and Service level Authentication & Authorization

QoS Negotiation and Assurance

Content adaptation, cache and forward techniques

Underlying Networks

Legend
- Entity standardized by NGSON
- Entity standardized out of NGSON
- Reference Point standardized by NGSON
- Potential reference point FFS / Logical Reference point for composite service
- Re1, Re2, Re3 and Re4 are external reference points
- R_1 - R_{20} are internal reference points

Features
- ◆ Self Organization
- ◆ Context Awareness
- ◆ Dynamic Adaptation
- ◆ Service QoS

10 Functional Entities
20 Reference Points

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1. Service Composition

- **Service Brokering**
  - **Static and Dynamic Service Chaining and Instantiation**
  - **Abstraction of Services for re-composability**
  - **Control the composition**
- **Specification Interpretation**

- **Adaptation**
  - **Re-composition**
  - **Optimization for best performance**
  - **Context Awareness**
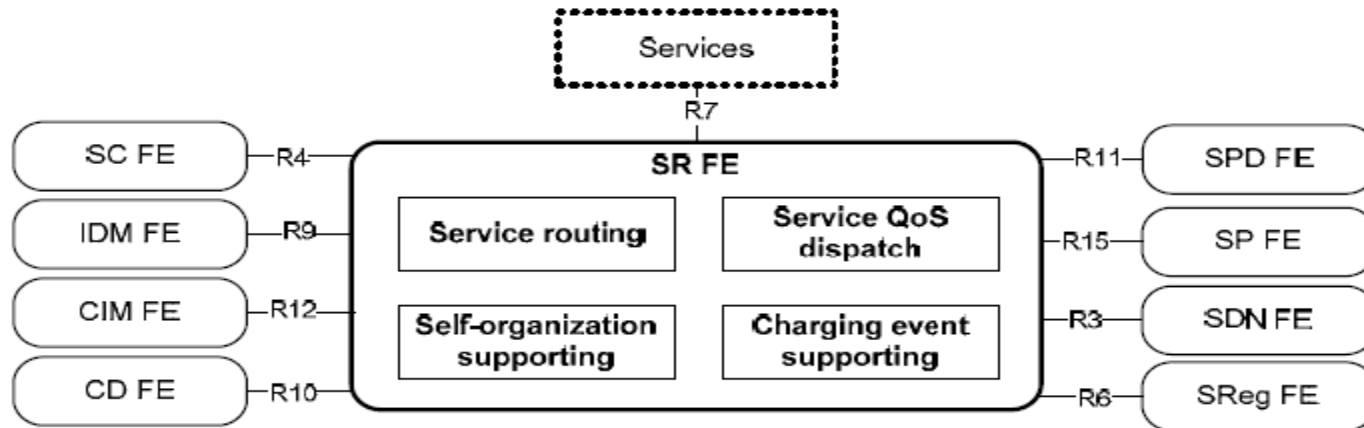- **Charging**

2. Service Discovery and Negotiation
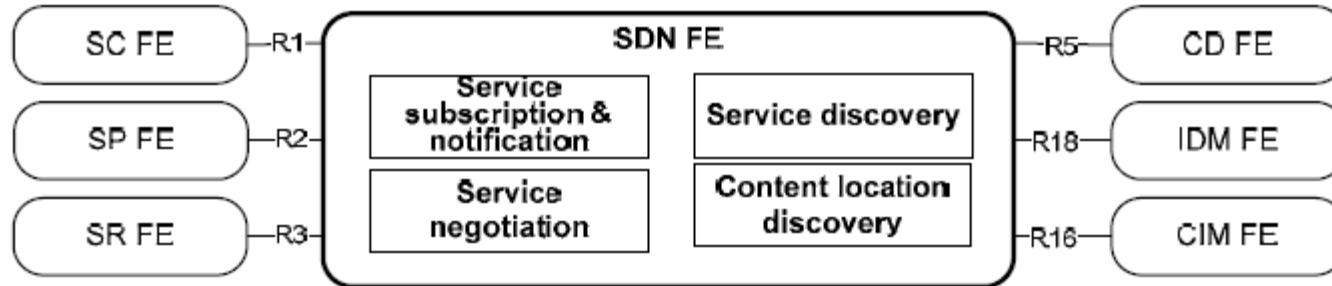
- **Discovery**
  - **Service matching based on service criteria and context**
  - **Service selection**
  - **Service Recommendation (list of similar services) based on Service Identity**

- **Negotiation**
  - **User profile based and Response based.**
- **Subscription and Notification**
- **Content Location Discovery**

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3. Service Routing

- **Service Routing**
  - **Forwarding based on service address, class, etc.**
  - **Context Aware Forwarding to single or multiple destinations (Intelligent)**
  - **Support the Service Composition adaptation**
  - **Interaction with other NGSON FEs**

- **Support Self Organization**
  - **Dynamic Adaptation of Overlay Network for context changes**
- **Service QoS Dispatch**
  - **Interfacing with SPD FE**
- **Charging Event Support**

4. Service Register
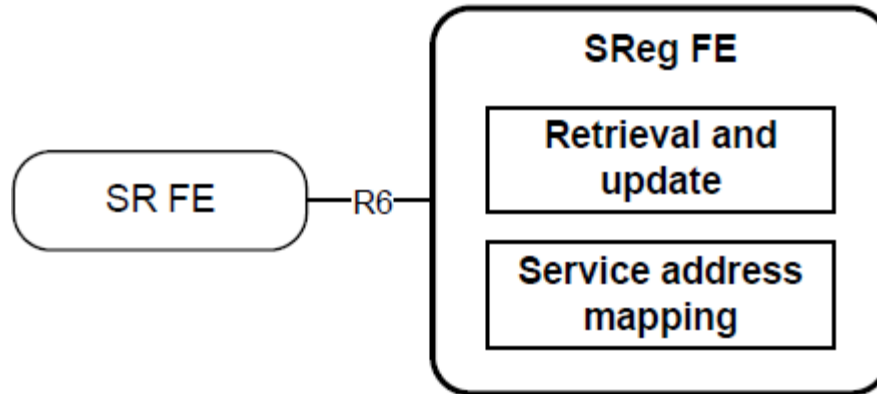
- **Retrieval and Update**

  - **Real time Service Registration**

  - **Manage dynamic information of the Service**

- **Service Address Mapping**

  - **Service Address Resolution to IP**

5. Identity Management
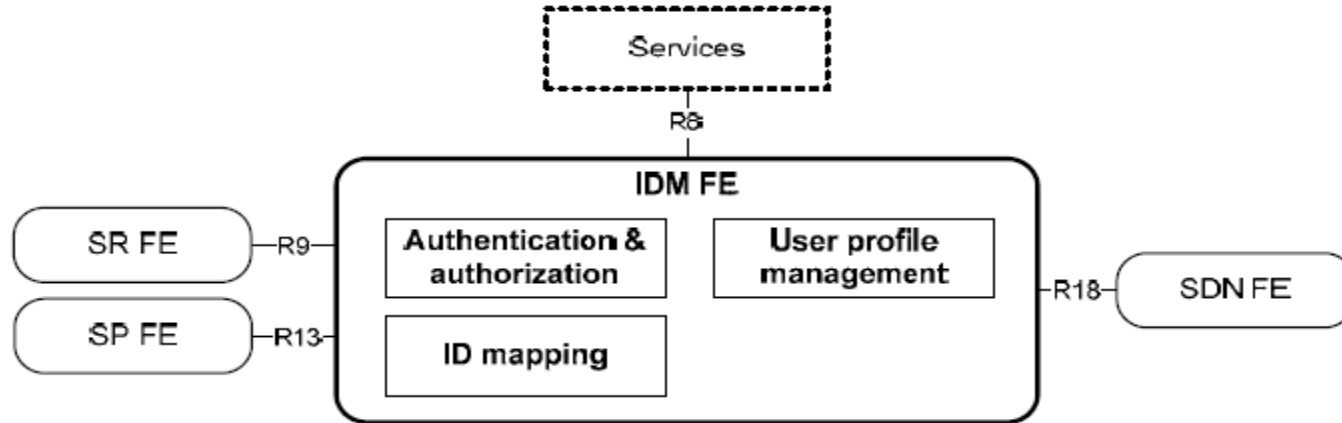
- **Authentication and Authorization**
    - **User and Service Level Identity Control and Mgmt.**
    - **Manage Identities based on Groups and Communities**
    - **Global ID – Support Single Sign On**

- **ID Mapping**
    - **Interoperability between Global (NGSON), Local (Service Provider specific) and Temporary (Anonymous) IDs**

- **User Profile Mgmt**
    - **User Data Models**

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6. Context Information Mgmt
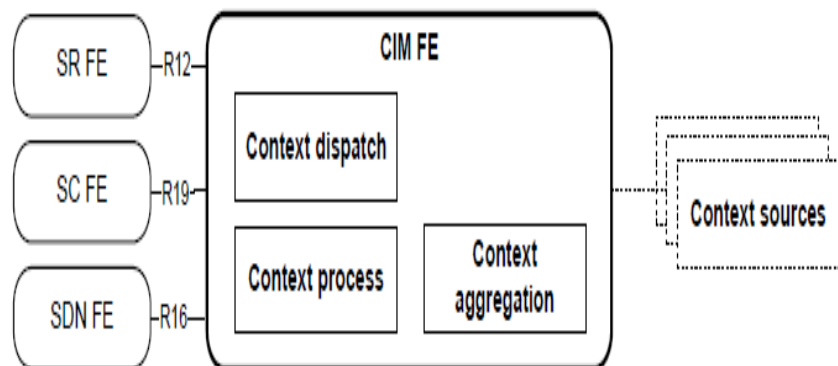
Context class	Examples of context
Service context	Service-related information such as service QoS, service performance, service availability, service roaming state, service triggers (such as policies, user feedback, and location), content, service category, service fees, service provider, and location where the service is available.
User context	User-related information such as location, environment constraint, terminal equipment used, preference, presence.
Network context	Network-related information such as network conditions (e.g., bandwidth, traffic topology) and performance.
Device context	Device-related information such as hardware configuration of device (e.g., device model, display, input/output modality), software configuration of device (e.g. operating system, mobile platform), and status of device [e.g., received signal strength (RSS), battery power, memory consumption].

- **Context Aggregation**
  - **Context Collection from different sources**
  - **Context change Monitoring**
- **Context Processing**
  - **Transformation and Filtering of Context Data and modeling different contexts.**

- **Provide high level contexts through interpretation**
- **Reasoning of context information**
- **Context Dispatch**
  - **Provide context for NGSON operations and applications.**

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7. Content Delivery
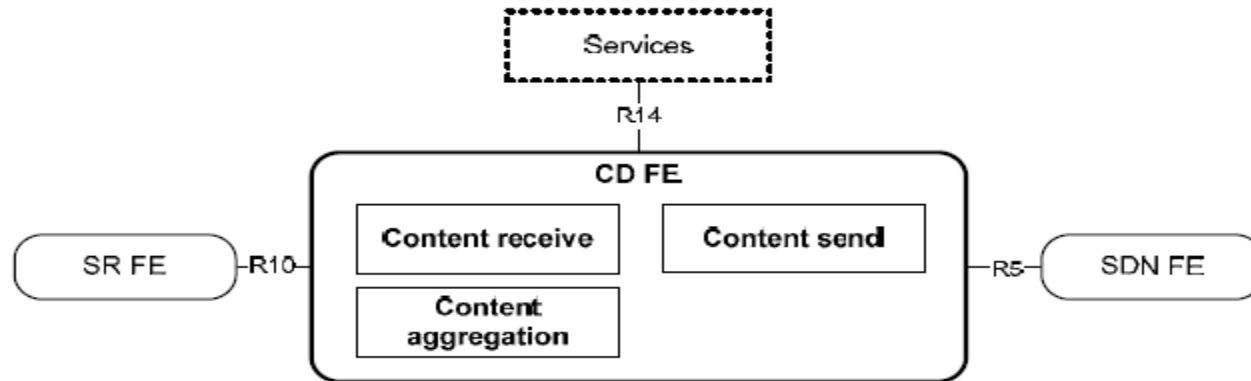
- **Receive**
  - **Storage selection (Cache vs. Permanent)**
  - **Location update with SDN FE**
  - **Distribution Policy Control for different storages and contents (stream vs. files)**

- **Aggregation**
  - **Storage (Cache, Cloud, CDN, etc)**
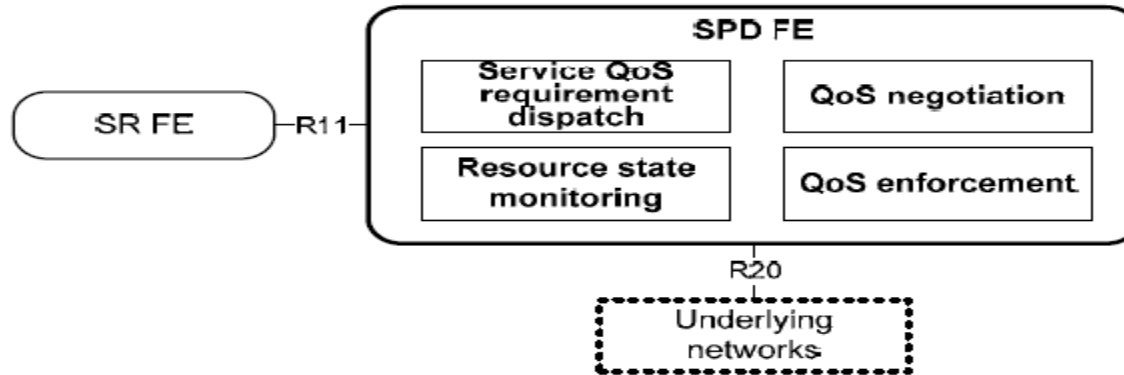 - **Merging and Synchronization**

- **Send**
  - **Best Delivery**
  - **Unicast vs. Multicast**

**Enables support for protocols like HTTP, FTP, P2P, RTSP, etc.**

8. Service Policy Decision

- **Service QoS Requirement Dispatch**

  - **Analyze & Derive the service QoS requirement from request.**

- **QoS Negotiation**

  - **Determine the best service provider based on resource state.**

  - **QoS admission control**

- **Resource State Monitoring**

  - **Query underlying networks**

  - **Monitoring**

- **QoS Enforcement**

  - **QoS reservation in the underlying network.**

  - **Allocate acceptable QoS based on the actual network condition.**

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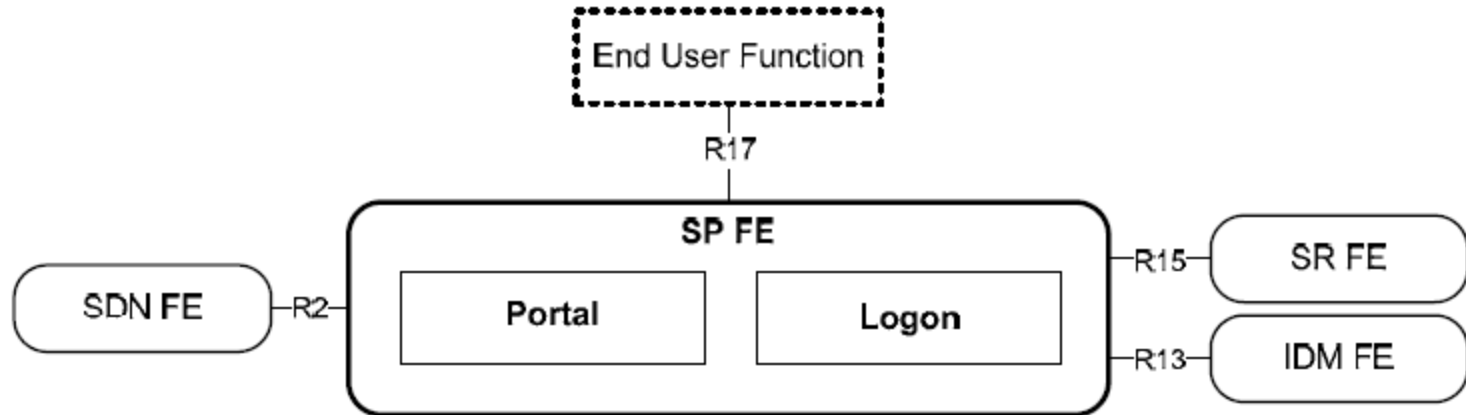
9. Service Portal

- **Portal**
    - **Subscribe to NGSON Services in Real time**
    - **Registration of Global ID**
    - **Forms the Service and content requests**
    - **NGSON Services Information rendering to the user.**

- **Log-on**
    - **Interface for Login.**
    - **Login session handling**
    - **Support authentication for service requests.**

10. Operation and Management
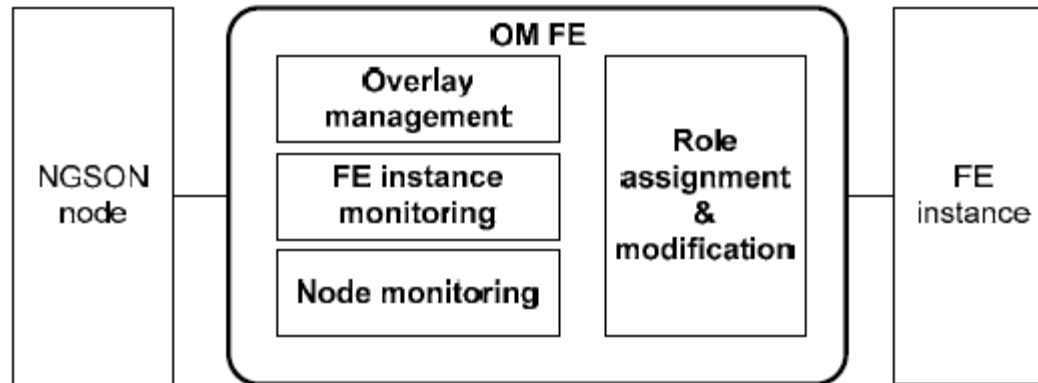
- **Overlay Management**

  - **Manages the Node and Functions information (Topology)**

  - **Capability negotiation with Physical systems**

- **Node Monitoring**

  - **Manages dynamic information of NGSON Nodes (resource)**

- **FE Instance Monitoring**

  - **Dynamic information of FE Instances (Status and Performance)**

- **Role Assignment and Modification**

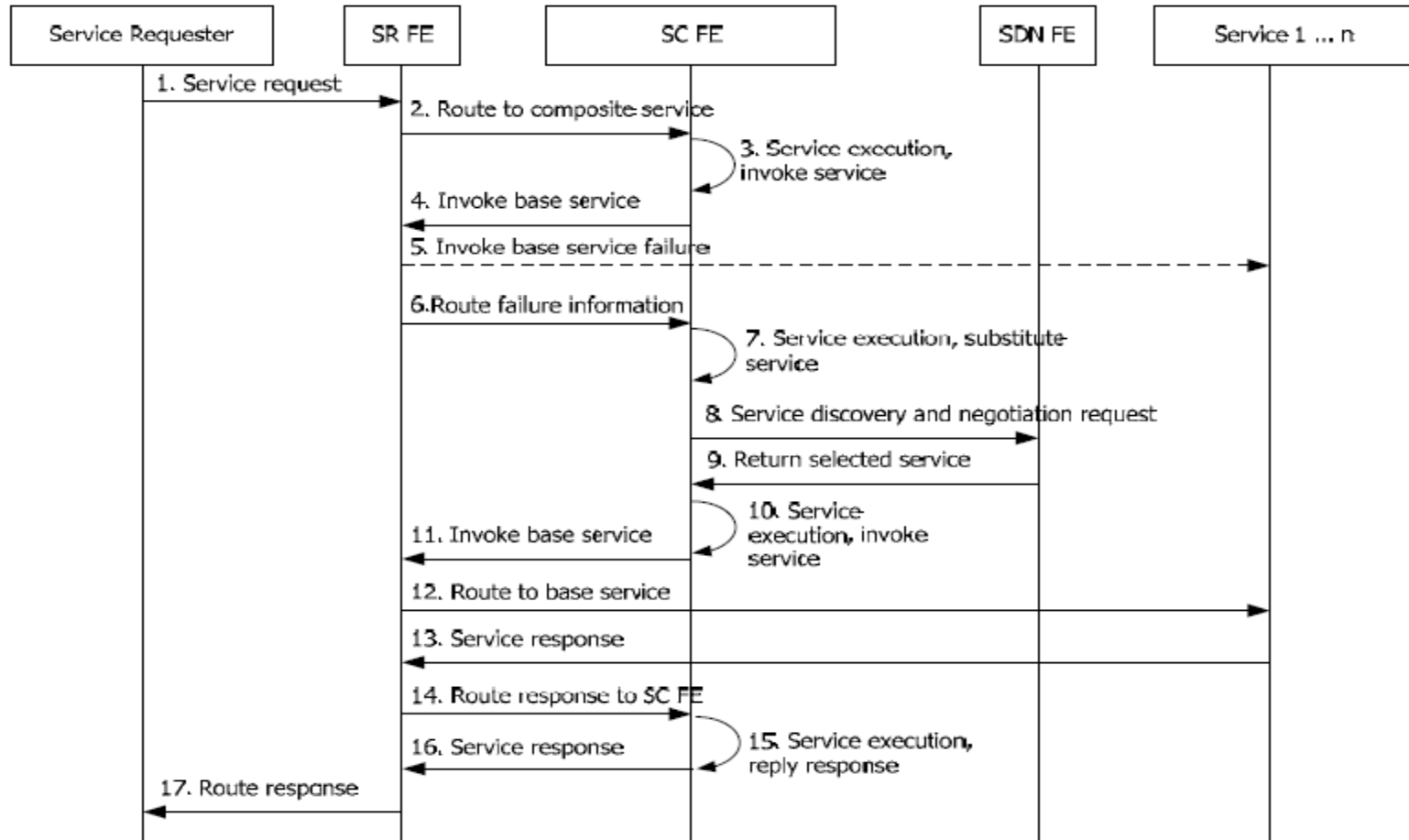 - **Reconfiguration for nodes and functions in NGSON.**

NGSON Key Features

- **Context Awareness**
- **Dynamic Adaptation**
- **Self Organization**
- **Service Routing**
- **Service Discovery and Negotiation**
- **Service Composition**

- **Content Delivery**
- **Service Mobility**
- **Security**
- **Service QoS**
- **Charging Events**

These key features are realized through interactions between the various NGSON FEs as described in NGSON Architecture
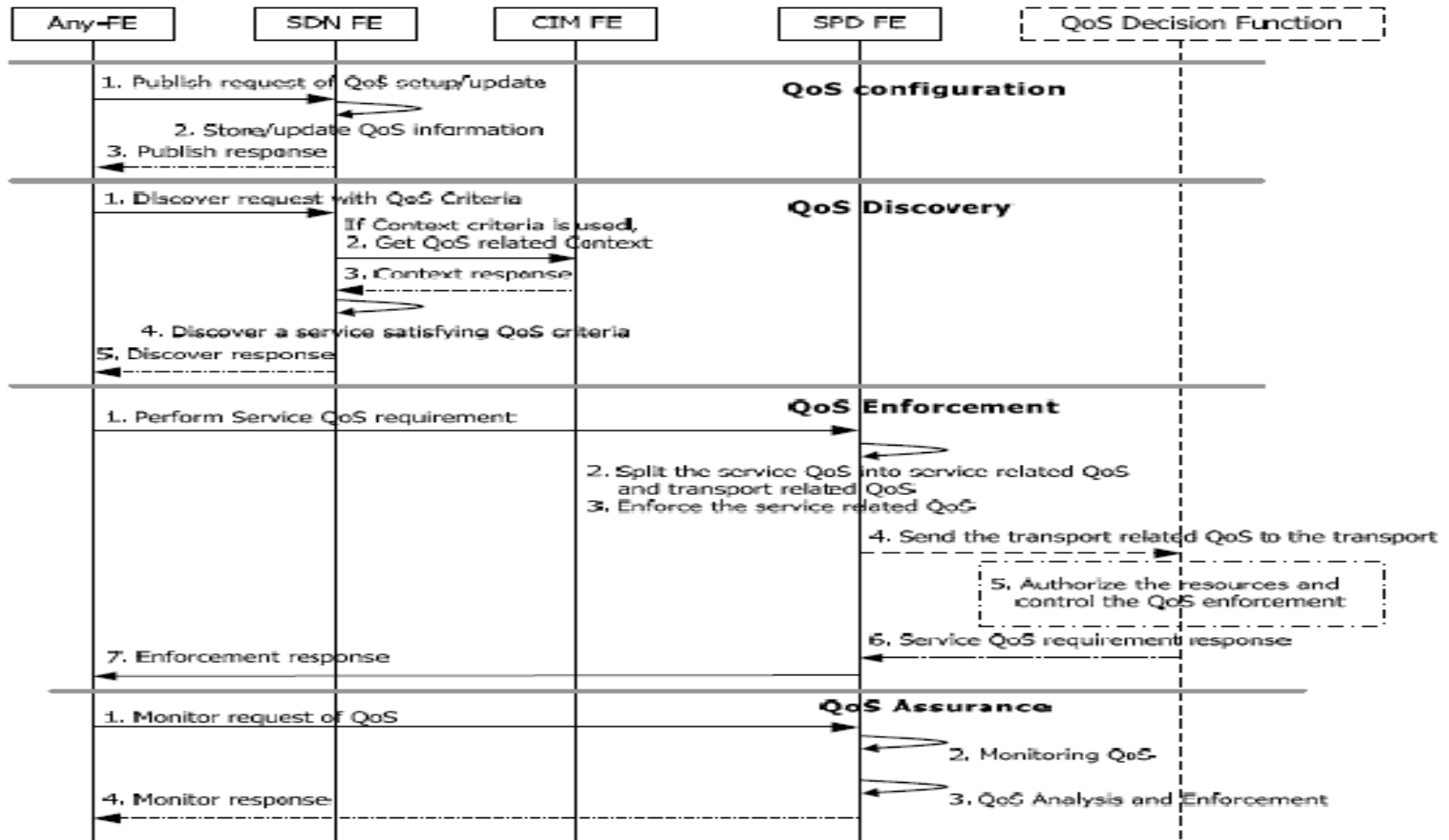
- **Service Substitution in Service Composition**

- **Service QoS Life cycle**

Any-FE	SDN FE	CIM FE	SPD FE	QoS Decision Function

QoS configuration
1. Publish request of QoS setup/update
2. Store/update QoS information
3. Publish response

QoS Discovery
1. Discover request with QoS Criteria
If Context criteria is used,
2. Get QoS related Context
3. Context response
4. Discover a service satisfying QoS criteria
5. Discover response

QoS Enforcement
1. Perform Service QoS requirement
2. Split the service QoS into service related QoS and transport related QoS
3. Enforce the service related QoS
4. Send the transport related QoS to the transport
5. Authorize the resources and control the QoS enforcement
6. Service QoS requirement response
7. Enforcement response

QoS Assurance
1. Monitor request of QoS
2. Monitoring QoS
3. QoS Analysis and Enforcement
4. Monitor response

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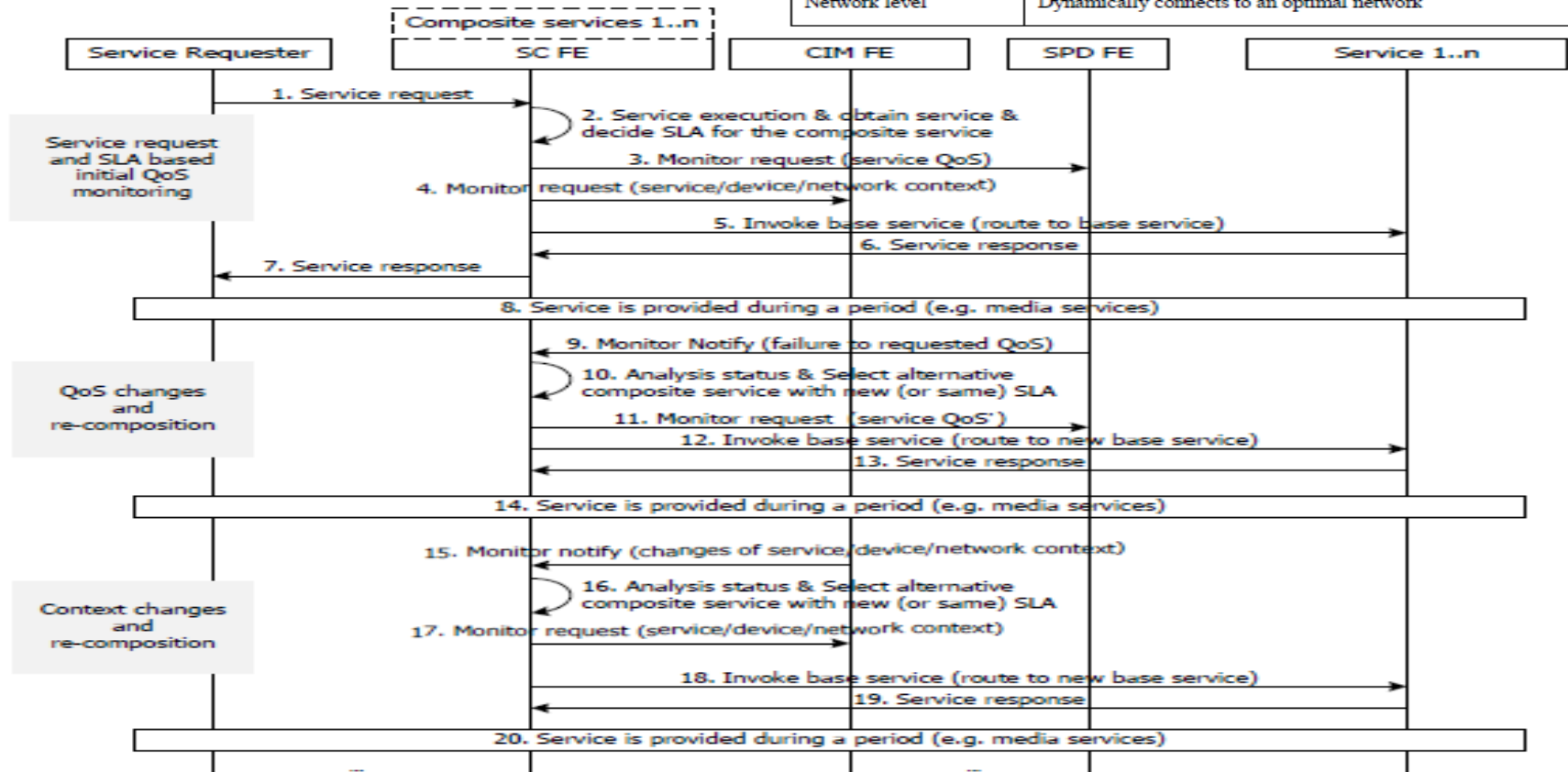# Examples of Key Features (3/5)

- **Service Mobility (Roaming)**
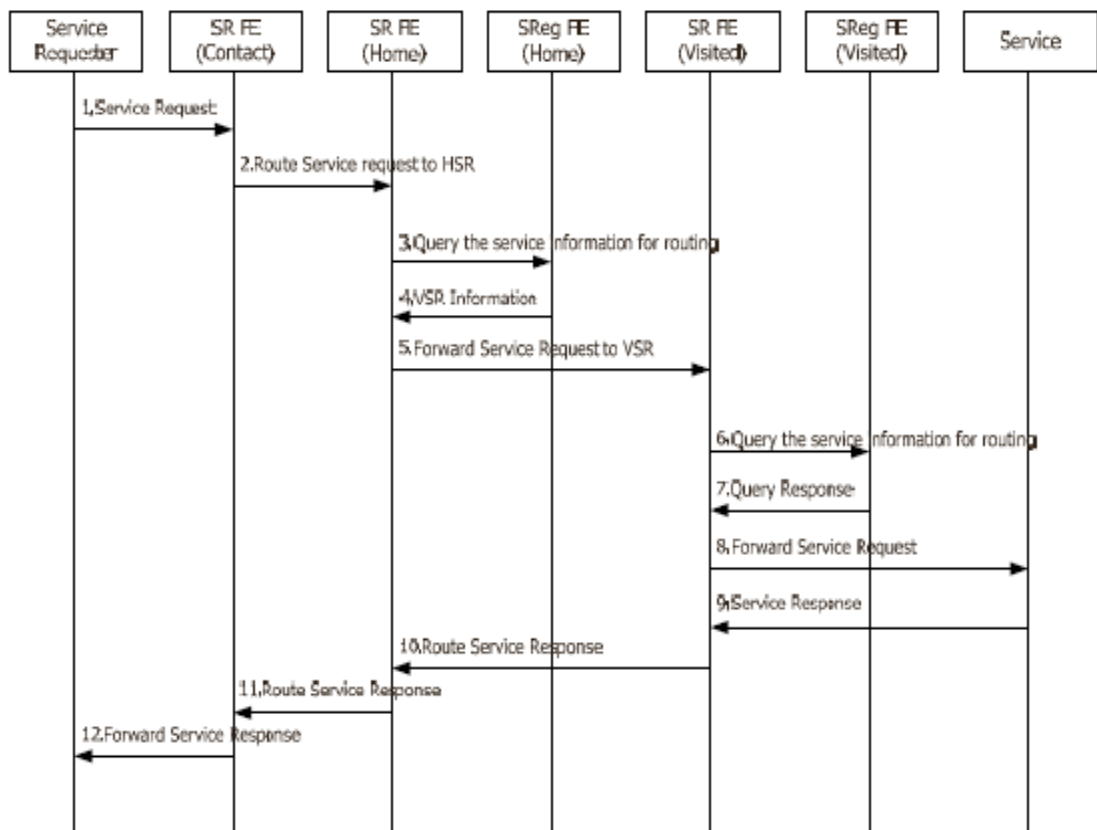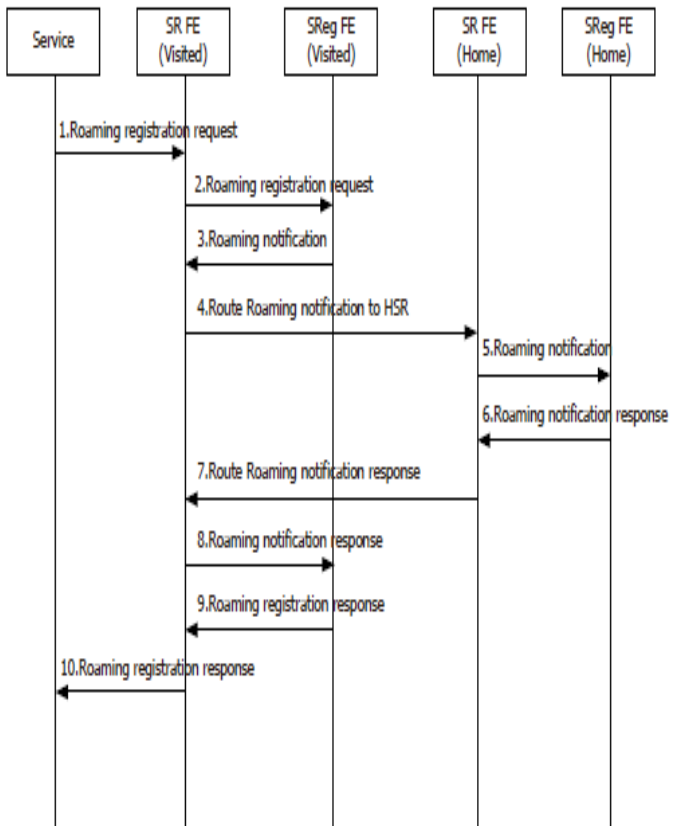
Examples of Key Features (4/5)

- **Dynamic Adapation**

Adaptation category	Adaptation examples
Service level	Service substitution (e.g., the use of another service component), service negotiation, dynamic service routing, and dynamic SC; dynamic selection and composition/decomposition of services; dynamic invocation of an appropriate service at runtime; dynamic QoS and media flow delivery based on context
User level	Multiple user interfaces for a service based on user's situation
Network level	Dynamically connects to an optimal network

Composite services 1..n

| Service Requester | SC FE | CIM FE | SPD FE | Service 1..n |

Service request and SLA based initial QoS monitoring

1. Service request
2. Service execution & obtain service & decide SLA for the composite service
3. Monitor request (service QoS)
4. Monitor request (service/device/network context)
5. Invoke base service (route to base service)
6. Service response
7. Service response
8. Service is provided during a period (e.g. media services)

QoS changes and re-composition

9. Monitor Notify (failure to requested QoS)
10. Analysis status & Select alternative composite service with new (or same) SLA
11. Monitor request (service QoS')
12. Invoke base service (route to new base service)
13. Service response
14. Service is provided during a period (e.g. media services)

Context changes and re-composition

15. Monitor notify (changes of service/device/network context)
16. Analysis status & Select alternative composite service with new (or same) SLA
17. Monitor request (service/device/network context)
18. Invoke base service (route to new base service)
19. Service response
20. Service is provided during a period (e.g. media services)

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Examples of Key Features (5/5)

- **Self Organization**
  - **Self Configuration**
  - **Self Optimization**
  - **Self Recovery**

Self-organization category	Self-organization examples
Node level	Self-recovery, self-optimization and self-configuration
Function entity level	Self-recovery, self-optimization and self-configuration
Service level	Dynamic negotiation, composition and substitution
Transport level	Network parameters tuning and transport-related substitution

OM FE Involved Self Organization
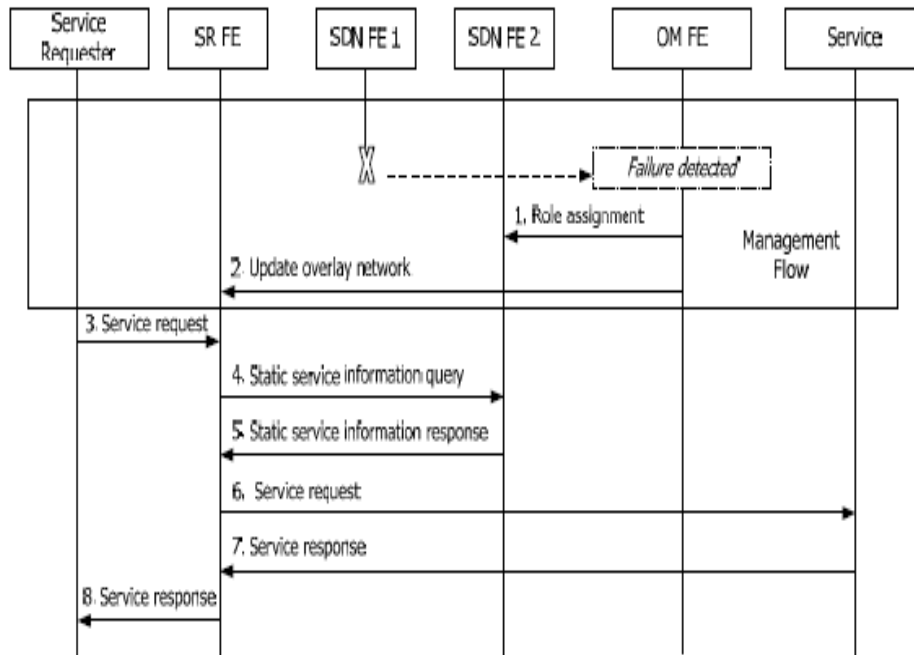
OM FE Non-Involved Self Organization
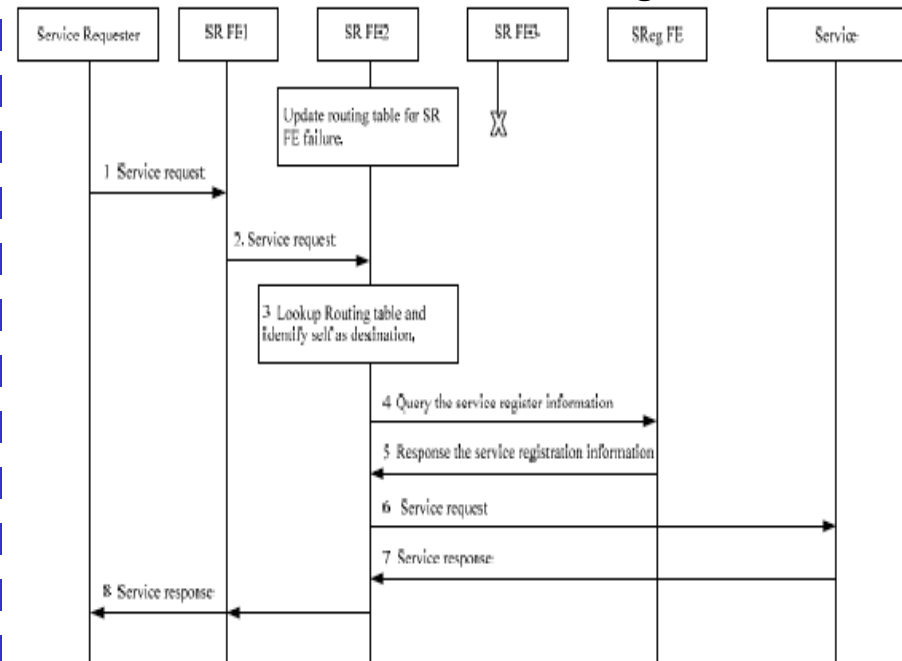
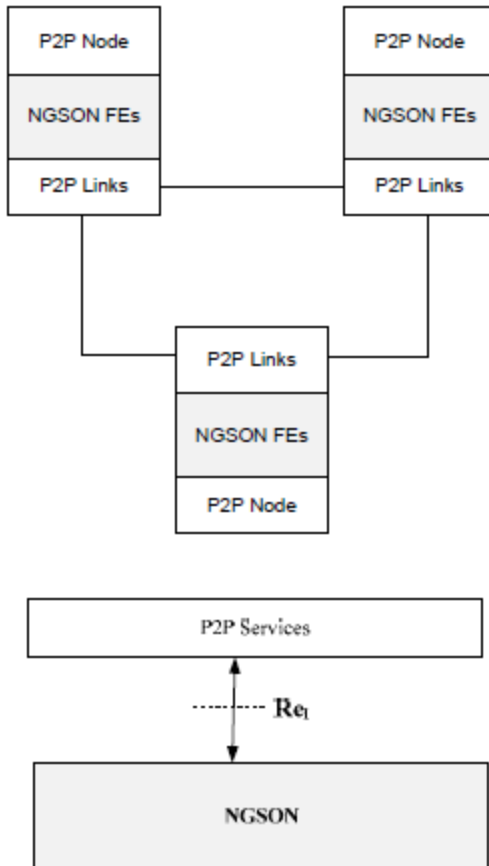# NGSON over Underlay Networks (1/3)

- ## NGSON over IMS
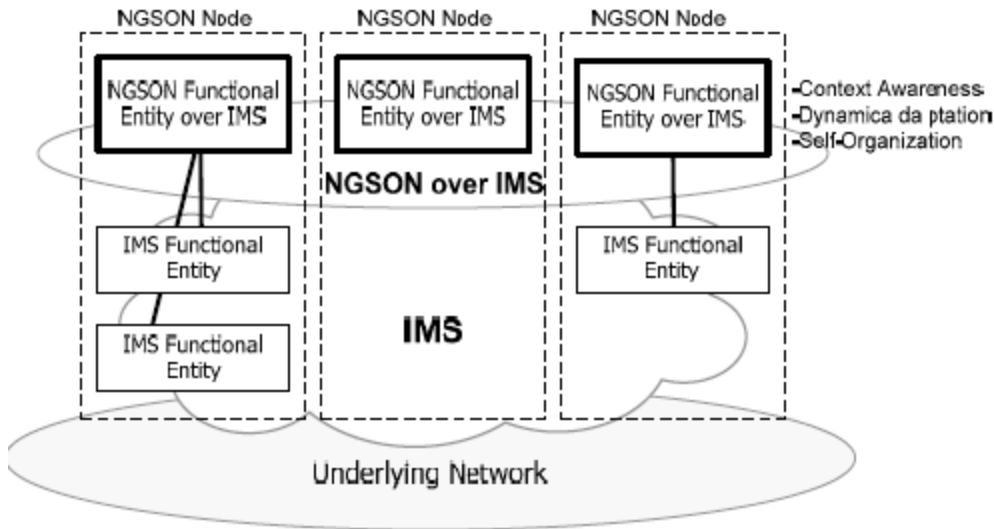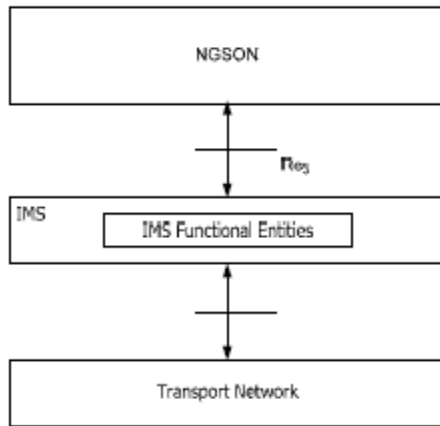
Service Composition of IMS and non-IMS Services
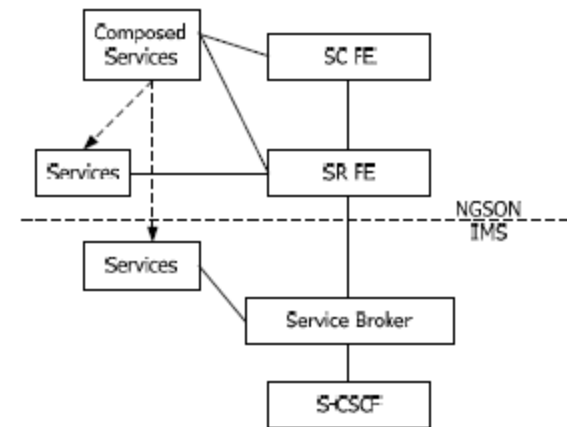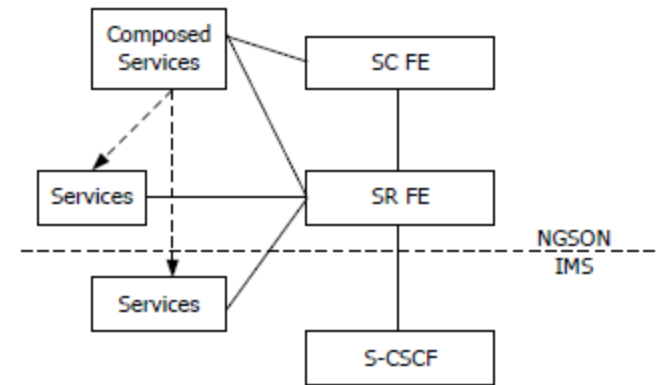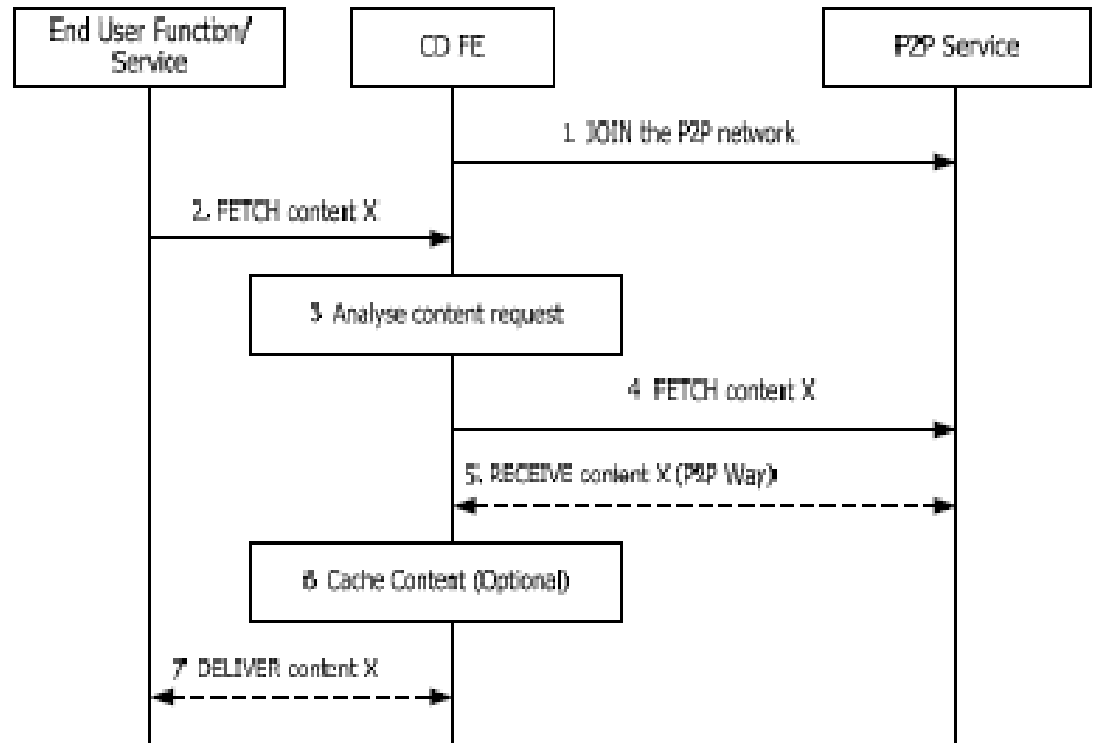
NGSON over Underlay Networks (2/3)

- ## NGSON over P2P

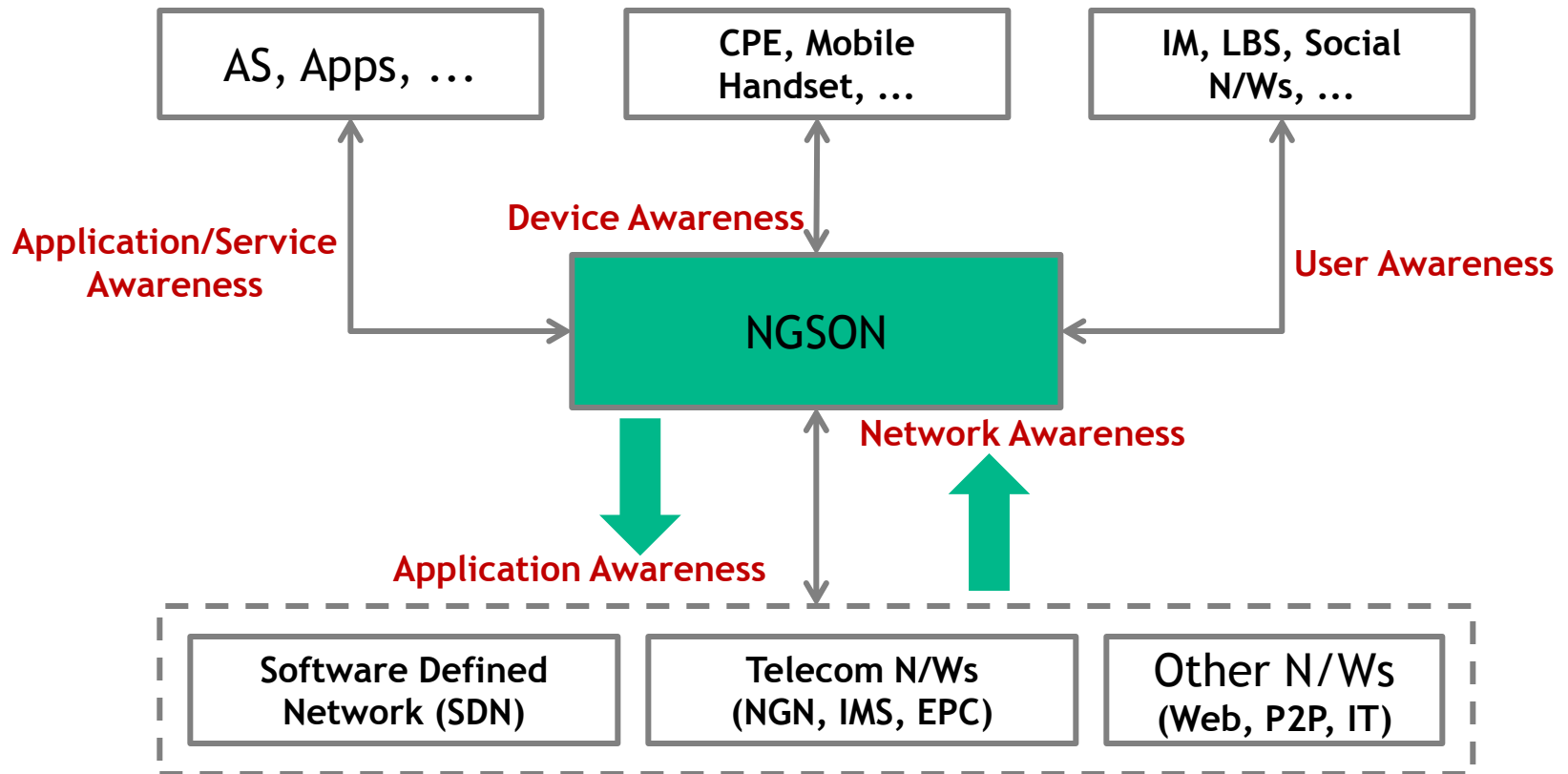

NGSON integration with P2P Service

NGSON over Underlay Networks (3/3)

- **NGSON with Web**

  - **Interaction (Security, Diversity, Sessions, Context Awareness & Adaptation) of Web Resources and NGSON Services.**

  - **Service Delivery – App Stores, Web Desktops, etc.**

  - **Service Composition - Mashups**

| Service Requester		NGSON				Web
Web Browser		SR FE	SReg FE	SP FE	Re1 (SPI)	Web Service/Web Sites (XML/SOAP/HTML/JSON)
Widget	Re2 (SRI)	SC FE	SDN FE	CD FE		Media based Web Service (FLASH/HTTP)
...		IDM FE	CIM FE	SPD FE	Re3	Web Infrastructure (Application Servers)

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X-Aware Service Ecosystem

# Current P1903 Standard Specifications

- **Focus on Standardization based on Key Features.**

- **Approach for Careful consideration and Fast Deployment.**

- **P1903.1**
  - **Content Delivery Protocols of NGSON**

- **P1903.2**
  - **Service Composition Protocols of NGSON**

- **P1903.3**
  - **Self-Organizing Management Protocols of NGSON**

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P1903.1 – Content Delivery

- **Purpose of P1903.1**

- **for network operators, service/content providers, and end users**

- **to provide and consume content services based on advanced content delivery capability of NGSON**
  - **with context-aware and dynamically adaptive features.**

- **to provide interoperability of content services between network operators and content providers.**
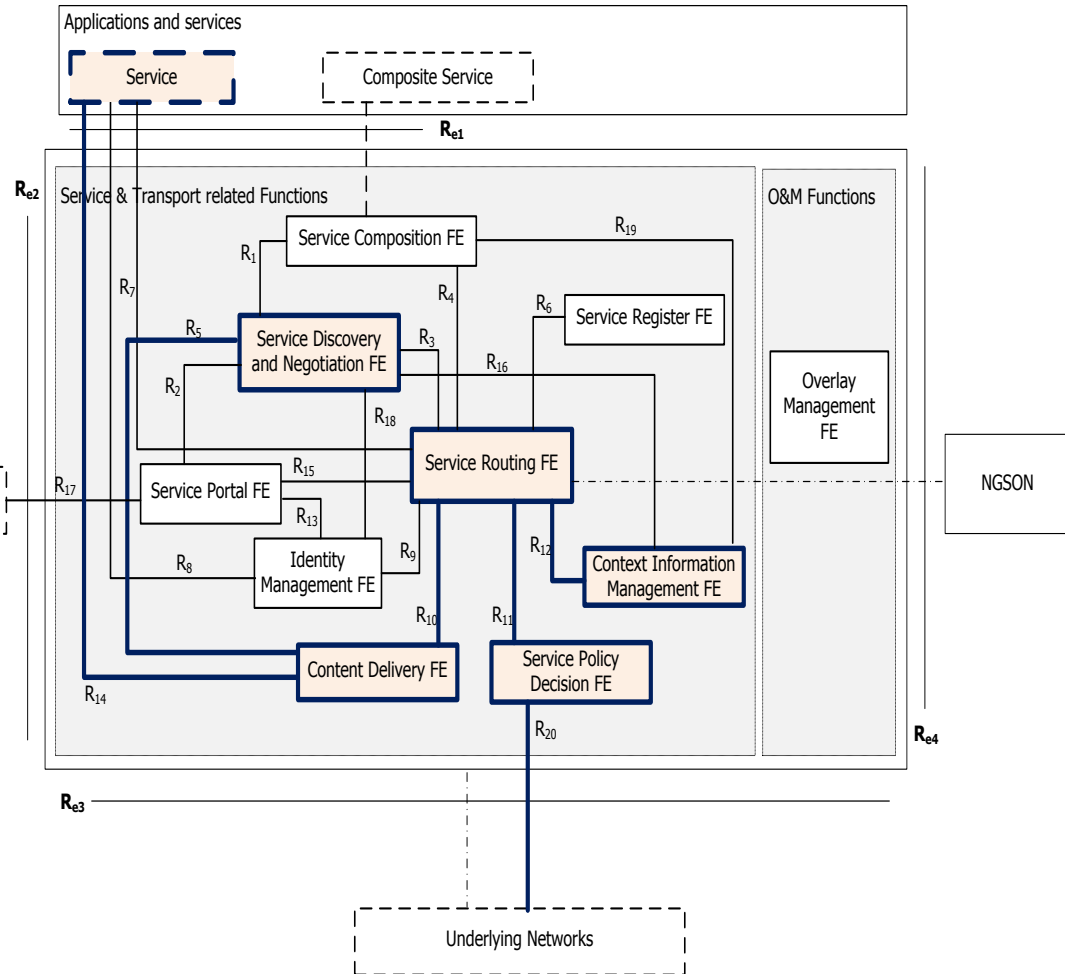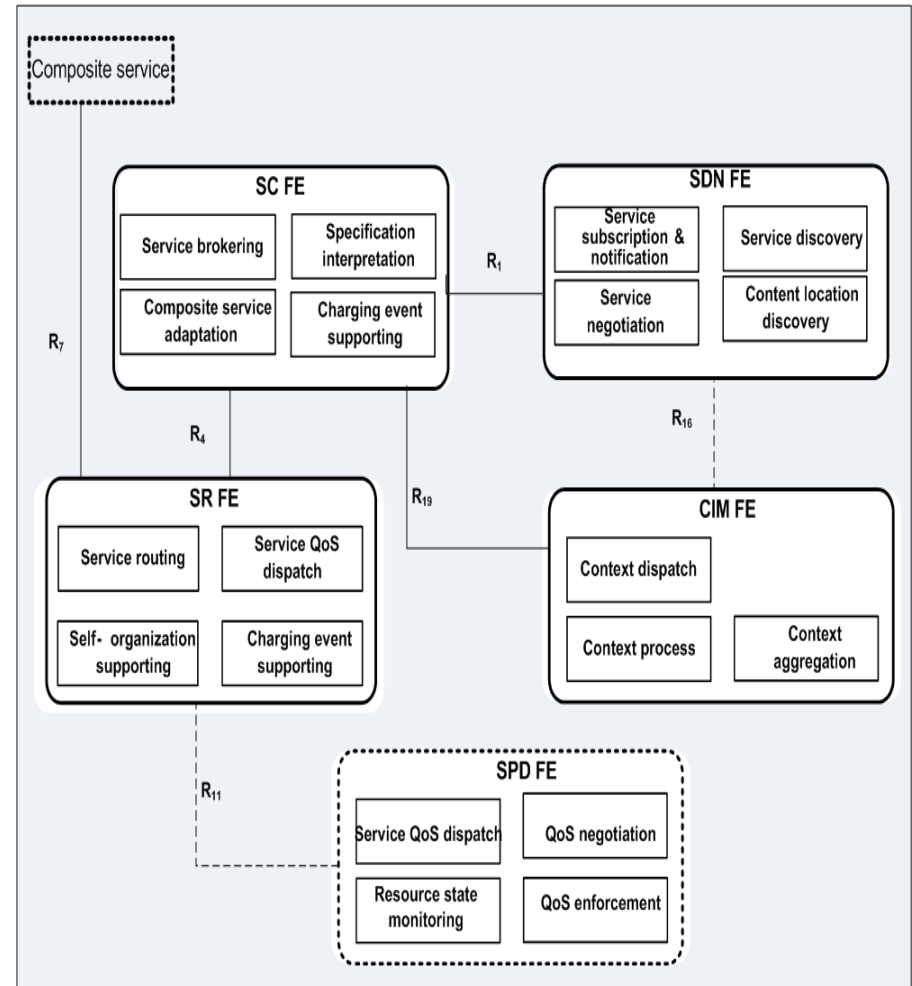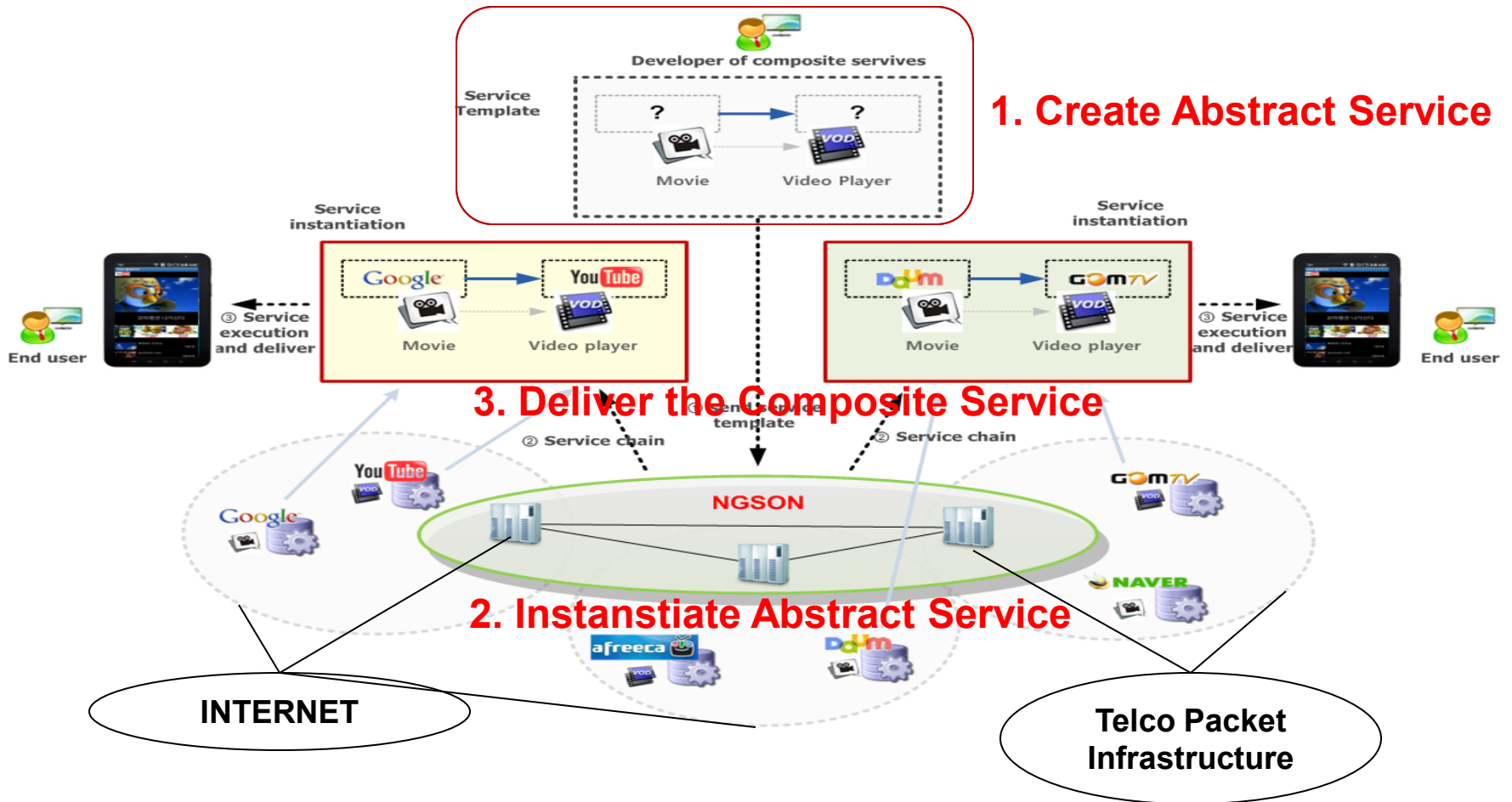
NGSON Content Delivery Operations
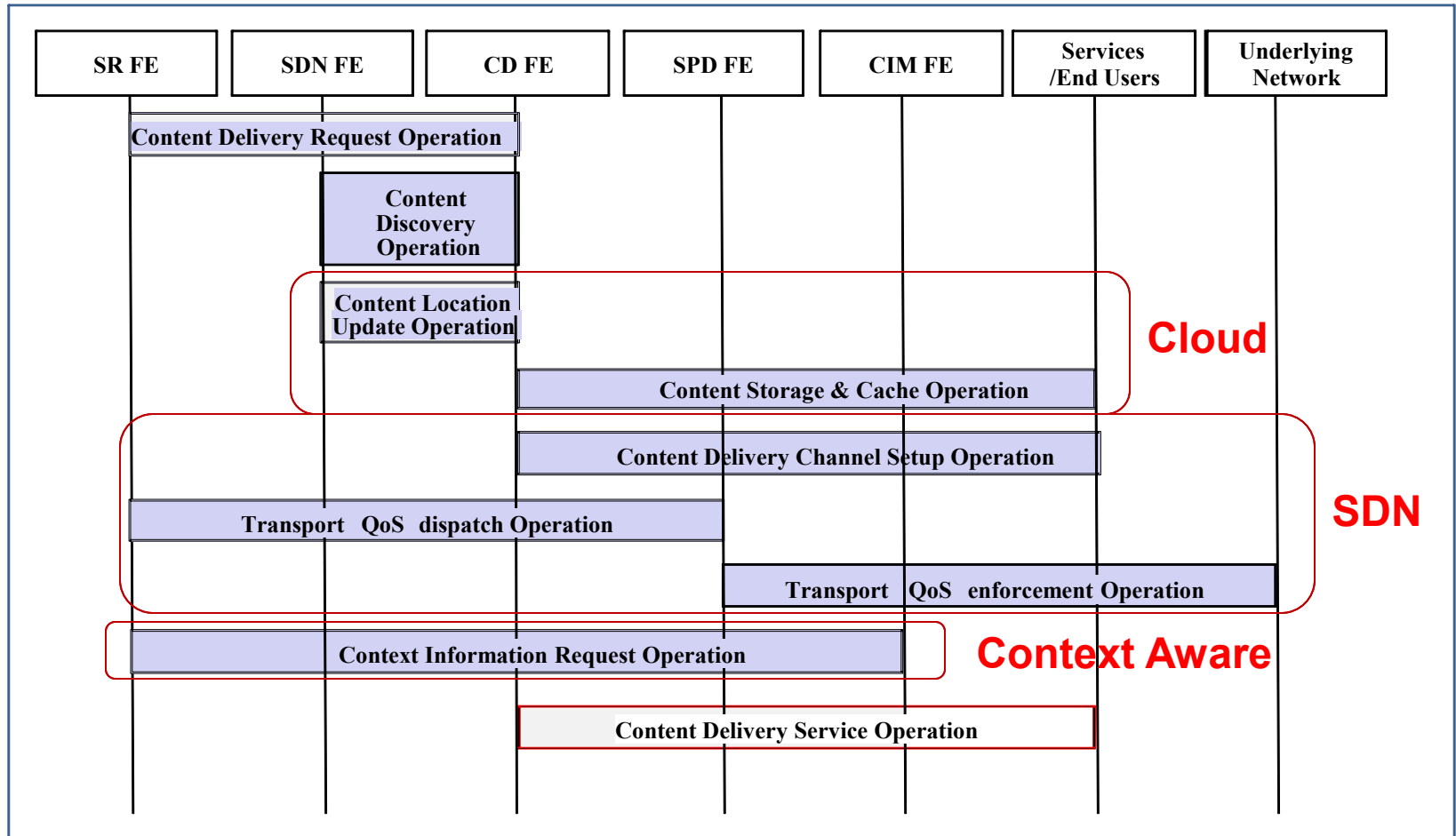
P1903.2 – Service Composition
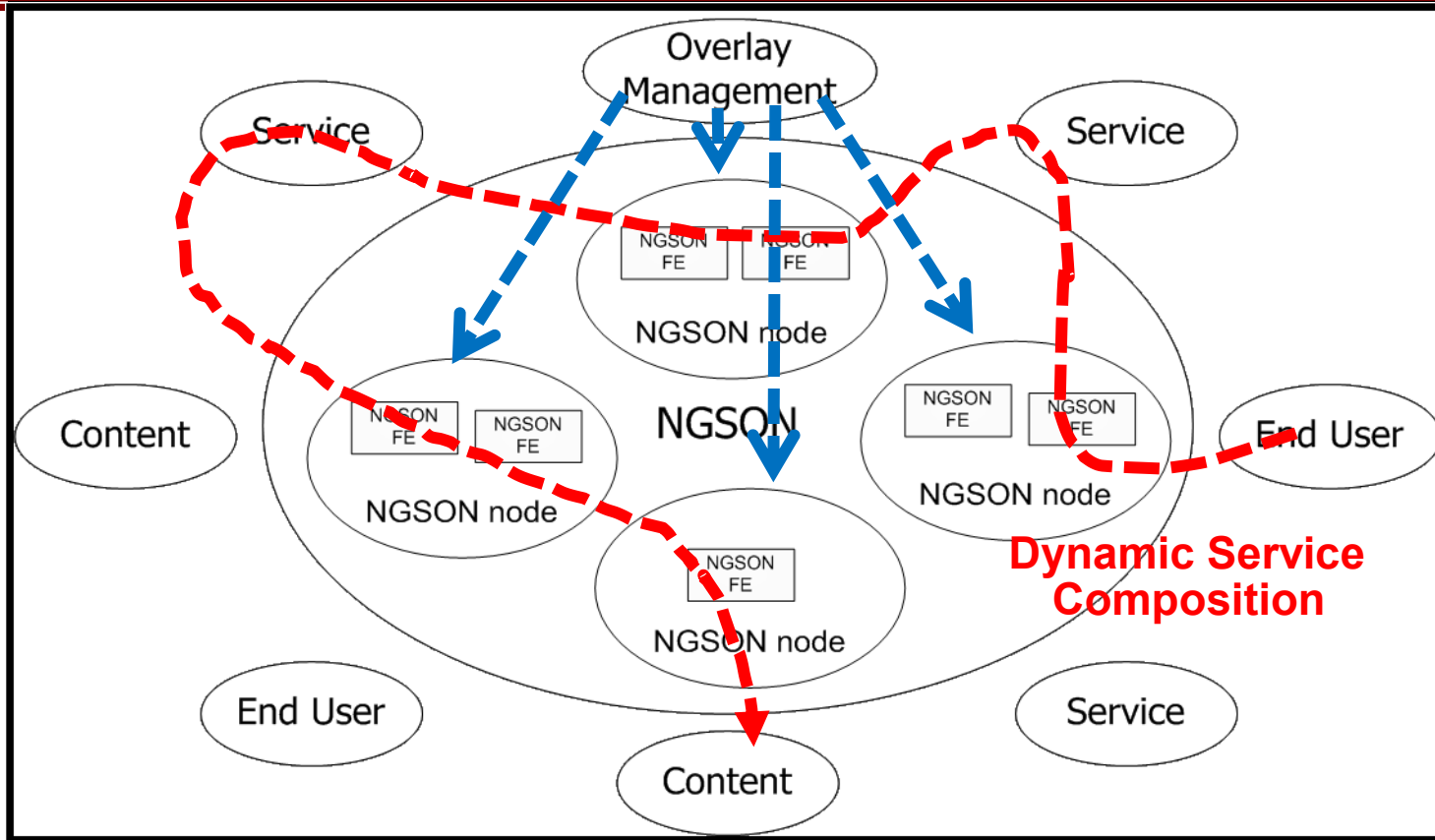
- **Project scope**

  This standard specifies protocols among Service Composition (SC) Functional Entity (FE), Service Discovery and Negotiation (SDN) FE, Context Information Management (CIM) FE, Service Routing (SR) FE and Service Policy Decision (SPD) FE to support service composition capabilities in next generation service overlay network. The capabilities of service composition aim to support service chaining and instantiation, specification interpretation, service brokering and execution, and context-aware and dynamically adaptive service composition.

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NGSON Service Composition Operations

1. Create Abstract Service

3. Deliver the Composite Service

2. Instanstiate Abstract Service

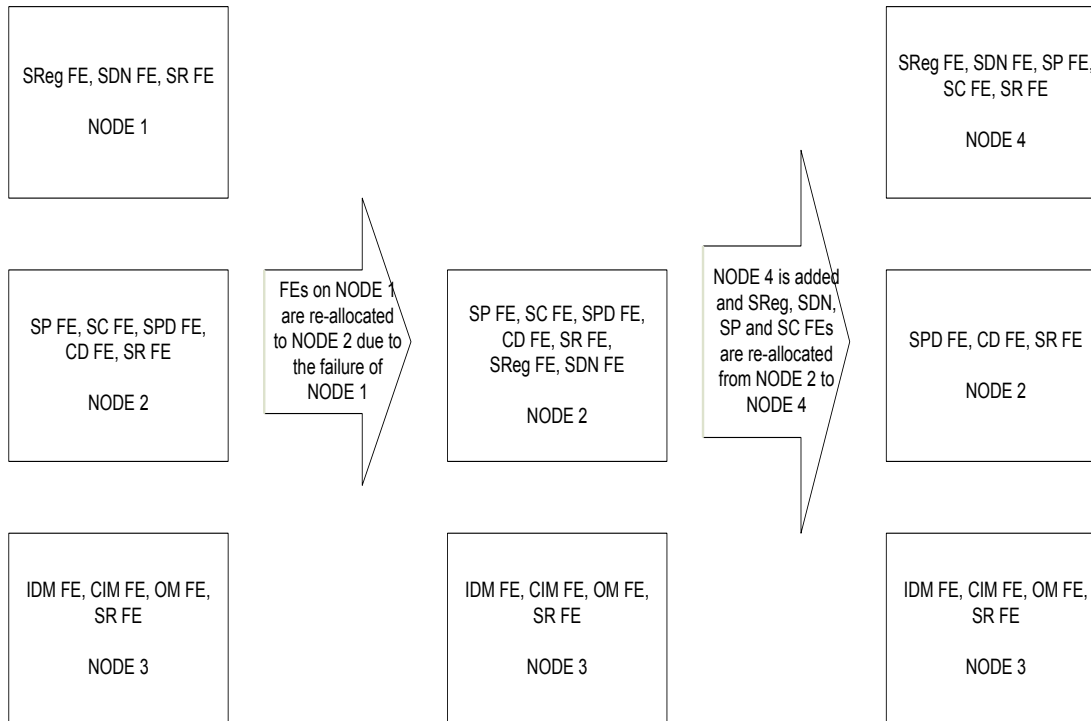# P1903.3 – Self Organizing Mgmt

Dynamic Service Composition

- **NGSON network operators to reduce OPEX of NGSON networks based on self-organizing management capabilities of NGSON including self-configuration, self-recovery and self-optimization of NGSON nodes and functional entities.**

NGSON Self Organization Operations

Self Configuration

ADD NGSON FUNCTION ENTITY
DELETE NGSON FUNCTION ENTITY
MOVE NGSON FUNCTION ENTIRY
COPY NGSON FUNCTION ENTITY
ACTIVATE NGSON NODE
DEACTIVATE NGSON NODE

Large Scale Deployment (Cloud)
Automated Management
Virtualized NGSON Functions
Decoupling Hardware and Software

NODE Level
FUNCTION Level
SERVICE Level
TRANSPORT Level

SReg FE, SDN FE, SR FE

NODE 1

SReg FE, SDN FE, SP FE, SC FE, SR FE

NODE 4

SP FE, SC FE, SPD FE, CD FE, SR FE

NODE 2

FEs on NODE 1 are re-allocated to NODE 2 due to the failure of NODE 1

SP FE, SC FE, SPD FE, CD FE, SR FE, SReg FE, SDN FE

NODE 2

NODE 4 is added and SReg, SDN, SP and SC FEs are re-allocated from NODE 2 to NODE 4

SPD FE, CD FE, SR FE

NODE 2

IDM FE, CIM FE, OM FE, SR FE

NODE 3

IDM FE, CIM FE, OM FE, SR FE

NODE 3
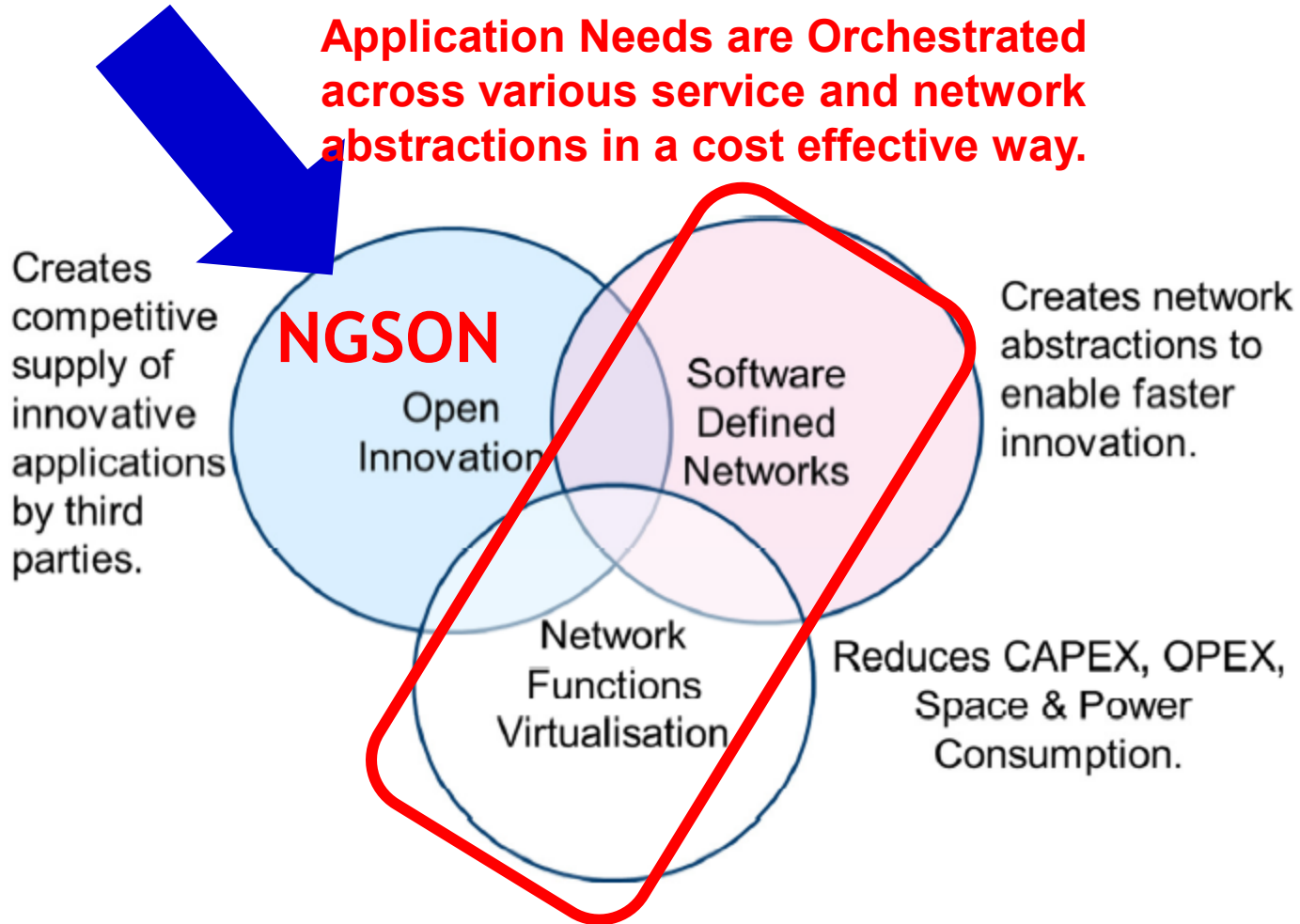
IDM FE, CIM FE, OM FE, SR FE

NODE 3

If Controlled by Overlay Management

➤ **Define Operations for Self-Organization**

➤ **Define Triggers for Self-Organization**

If Not Controlled by Overlay Management

➤ **P2P Self-Organizing Management**

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NGSON Impact on Monetization Trend

Application Needs are Orchestrated across various service and network abstractions in a cost effective way.

Creates competitive supply of innovative applications by third parties.

NGSON
Open Innovation

Software Defined Networks

Network Functions Virtualisation

Creates network abstractions to enable faster innovation.

Reduces CAPEX, OPEX, Space & Power Consumption.

SDN (Open Flow) & NfV allows to create a more powerful application strategy based on NGSON for the service provider

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Thank you!

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