

Future Network : Problem Statement and Requirements

M-K. SHIN
mkshin@etri.re.kr
ETRI

05. 12. 2011
FI Standard Workshop@Seoul, Korea

Content outline

- Motivation and current status
 - ISO/IEC JTC 1/SC 6
 - ISO/IEC DTR 29181-1 Future Network : Problem Statement and Requirements – Part 1 : Overall Aspects
 - FN Definition from ISO/IEC JTC 1/SC 6
- Related works
- Problem statement
- General requirements
- Milestone for standardization
- Wrap-up and discussion

Future Internet

- Common understanding from Wikipedia
 - the approaches from **small, incremental evolutionary steps** to **complete redesigns (clean slate) and architecture principles**,
 - where the applied technologies shall not be limited by existing standards or paradigms
 - to be long term, taking several years
 - **too early to identify any technical consensus or even standardization**

Future Internet or Network

- However, different name, scope, and approaches
 - **Future Internet** (FI)
 - FIND, FIA (Future Internet Architecture) (US)
 - FP7 – Future Internet (EU)
 - IETF/IRTF (*Make the Internet Better*)
 - **Future Network** (FN, singular)
 - ISO/IEC JTC 1/ SC 6
 - Internet vs. OSI 7 layers
 - **Future Networks** (FNs, plural)
 - ITU-T SG13 - Future networks including mobile and NGN
 - Q.21/13 – Future Networks

SC6's scope and current status

- SC6 is working on the separated 8 parts within the same Project (29181)
 - **Part 1: Overall aspects (PSR)**, Part 2: Naming and Addressing, Part 3: Switching and Routing , Part 4: Mobility, Part 5: Security, Part 6: Media Transport, Part 7: Service Composition, Part 8: Federation
- Part 1 document mainly describes
 - the definition, general concept, **problems and requirements** for Future Network (FN).
 - Also, it discusses **a milestone for standardization** on Future Network (FN).
- **Part I is almost done**
 - **Close of DTR voting (ISO/IEC TR 29181-1)**

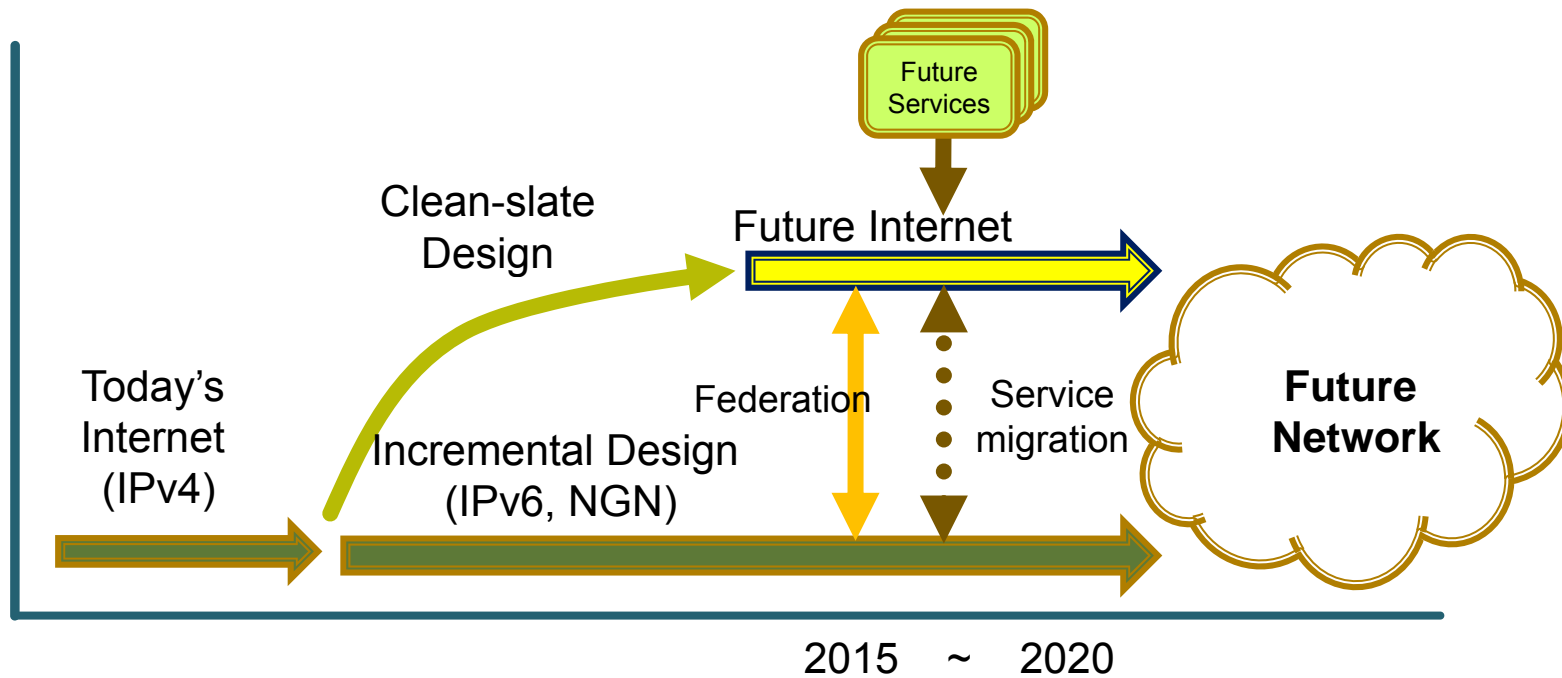
Definition from SC 6

- Future Network (FN):
 - The FN is the network of the future which is made on **clean-slate design approach** as well as incremental design approach.
 - It should provide **futuristic capabilities and services beyond the limitations of the current network** including the Internet.

Futuristic capabilities

- Network virtualization and programmability
- Cross-layer communication
- Autonomous services
- Context-awareness services
- Content-centric networking
- Service composition
- Customizable QoS/QoE
- Economic incentives
- And more ...

SC6's vision and roadmap



SC 6/WG 7 FN project

Project #	Designation	Title	Status
37.01.01	29181-1	Future Network : Problem Statement and Requirements – Part 1: Overall aspects	DTR (Close of voting)
37.01.02	29181-2	Part 2: Naming and Addressing	WD
37.01.03	29181-3	Part 3: Switching and Routing	WD
37.01.04	29181-4	Part 4: Mobility	WD
37.01.05	29181-5	Part 5: Security	WD
37.01.06	29181-6	Part 6: Media Transport	WD
37.01.07	29181-7	Part 7: Service Composition	WD
37.01.08	29181-8	Part 8: Federation	WD

Related works

- ITU-T SG13
 - Rec. Y.3001 (2011) Future Networks : Objectives and Design Goals
- EU FIA Reference Architecture WG
 - White Paper, Fundamental Limitations of current Internet and the path to Future Internet
- IETF/IRTF
 - Formed : DTN, P2G, RRG, VNRG
 - Under consideration : SDN, CSO, ICN, EE, etc.

Problem statement

- Basic problems
- Problems with fundamental design principles of current Internet

12 Basic problems

1. Routing failures and scalability
2. Insecurity
3. Mobility
4. Quality of service
5. Heterogeneous physical layers, applications and architecture
6. Network management
7. Congestive collapse
8. Opportunistic communications
9. Fast long-distance communications
10. Lack of efficient media distribution
11. Customizability
12. Economy and policy

4 Problems with Internet's principles

1. Packet switching
2. Models of the end-to-end principle
3. Layering
4. Naming and addressing

12 General requirement (1/5)

1. Scalability

- The FN SHOULD support scalable routing architecture
 - Routing and addressing architecture
 - Multi-homing and provider independence (PI routing)

2. Routing and addressing scheme

- The FN MAY need a new routing and addressing scheme
 - The new naming and addressing schemes should take the advantage of the principle of clean slate design to explore, identify, experiment complete new architecture.
 - The new architecture does not have to abide by the old network naming and addressing rules, but on the other hand, the issue of compatibility and interoperability should also be considered when technical proposals are evaluated.
 - An architecture which would help FN to achieve objectives such as scalability, security, mobility, robustness, heterogeneity, quality of service, customizability and economic incentive.

12 General requirement (2/5)

3. Security

- The FN SHOULD be built on the premise that security must be protected from the plague of security breaches, spread of worms and spam, and denial of service attacks, and so on.

4. Mobility

- The FN SHOULD support mobility of devices, services, users and/or groups of those seamlessly.
 - Separation of user identifier and device locator
 - Separation of mobility control function from user data transport function
 - Location privacy in mobility
 - Support of network-based built-in mobility control
 - Route optimization
 - Use of lower layer information
 - Support of flow-level mobility

12 General requirement (3/5)

5. Customizable quality of service

- The FN SHOULD support quality of service (QoS) from user and/or application perspectives. In addition, QoS in the FN is expected to support service composition and context-awareness

6. Heterogeneity and network virtualization

- The FN SHOULD provide much better support for a broad range of applications/services and enable new applications/services. In addition, it should accommodate heterogeneous physical environments.
 - Separation of user identifier and device locator
 - Application/service heterogeneity
 - Device heterogeneity
 - Physical media heterogeneity
 - Network virtualization

12 General requirement (4/5)

7. Service awareness

- The FN SHOULD provide services efficiently taking into consideration the requirements posed by each communication.
 - Service Discovery
 - Service Composition
 - Self-organizing service Context-awareness, and
 - Service QoE

8. Media transport

- The FN SHOULD support efficient methods to deliver media

9. New layered architecture

- The FN MAY need a new layered architecture.

10. Management

- The FN SHOULD support Instant and easy management.
 - Robustness
 - Autonomy

12 General requirement (5/5)

11. Energy efficiency

- The FN SHOULD provide energy saving capabilities to support green ICT environments.

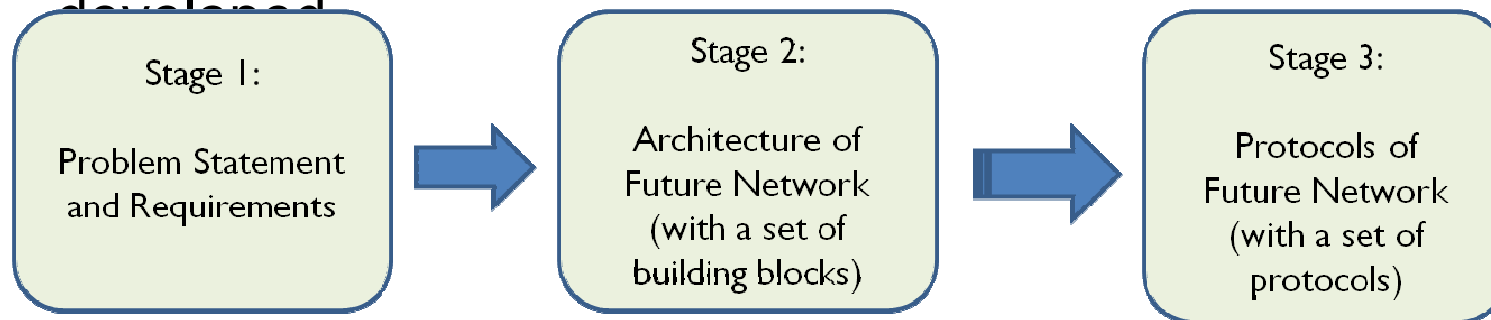
12. Economic incentives

- The FN SHOULD provide economic incentives to the infrastructure providers, service providers, and end users that contribute to the networking.
 - Quality of service/experience
 - Manageability
 - Customizability
 - AAA and security
 - Operational aspect

Milestone for standardization

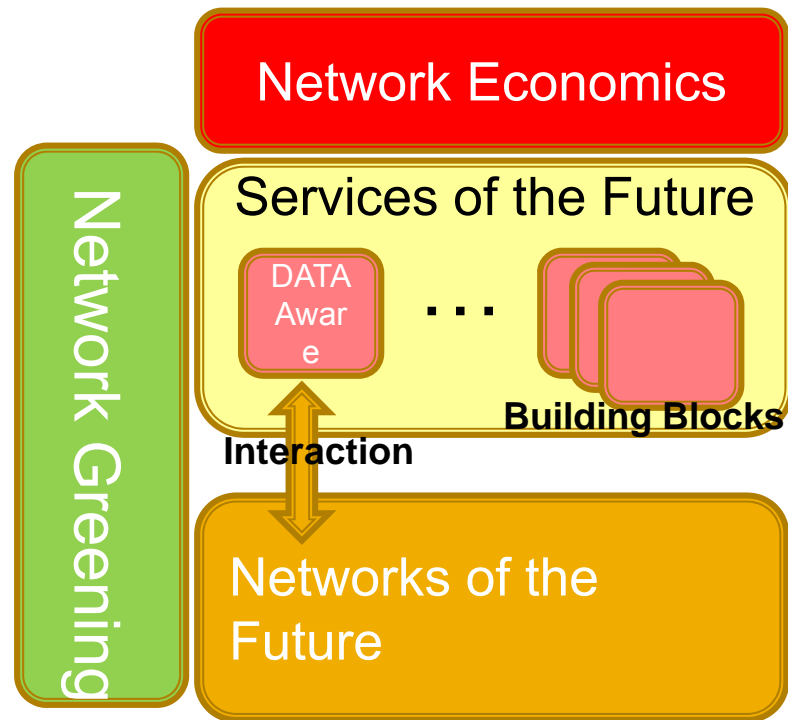
■ Overall work plan

- In Stage 1, in this TR, a set of requirements and considerations are identified for design of the FN architecture.
- In Stag 2, the FN architecture will be designed.
 - The design of FN architecture can be done with a set of architectural building block (BB) components for overall FN architecture.
- In Stage 3, one or more specific protocols of FN might be developed.



Building Blocks (and My Own View)

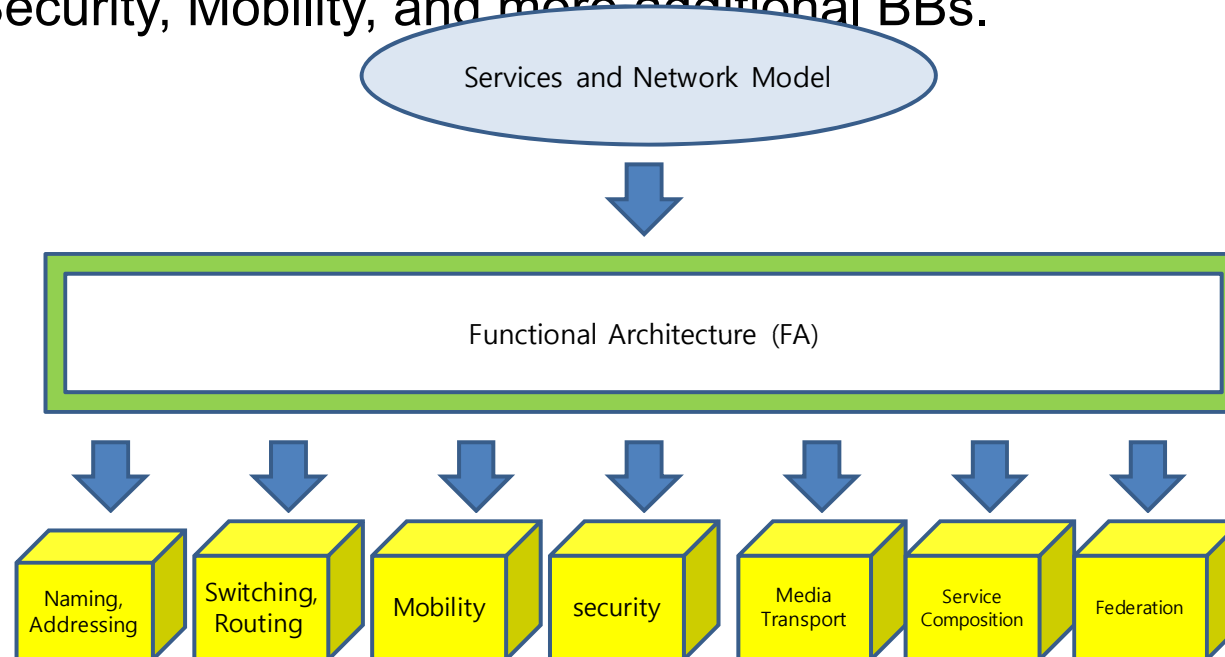
- *Building Blocks (BBs)*
 - *a technique for development of a set of standards by creating some basic modules or elements that may be added together so as to obtain an overall architecture or entire operations.*



Polymorphic Networks - Architecture

BB component for FN architecture

- The Services and Network BBs will be used as substantial inputs to design the generic Functional Architecture (FA) BB.
- Specific functional BBs designed:
 - Switching/routing, Service composition, Media distribution, Security, Mobility, and more additional BBs.



Wrap-up and discussion

■ Summary

- ISO/IEC 29181-1 Part I is ready to be published.
 - *Problems and General Requirements*
 - *Milestone for Standardization*
 - *Building blocks*

■ Open Discussion

- Not too early to standardize individual protocols and architectures ?
 - Pre-standards vs. standards
- Definition and scope
 - Future networks vs. Future network
 - Future Internet
- Avoid any conflicts ?
 - Global collaboration and harmonization required