PROGRAMMABLE NETWORKS

As the Networked Society emerges, with everything connected and an increasing number of processes using ICT to reach their full potential, connectivity needs to change. It needs to be differentiated, and the network must actively contribute to the overall service experience. Networks must be programmable to provide the right performance, at the right time.

We know Real Application Performance

October 2014

CONTENTS

BETTER THAN BEST EFFORT

When every user, application and industry has different connectivity needs, 'best effort' is not always good enough. Service providers should be able to differentiate between services for different consumers and connected industries, supplying varying connectivity requirements for a multitude of applications. For example, would a connected self-driving car have the same network requirements as the entertainment playing in the backseat?

The future of connectivity

Broadband services developed from a standardized, all-you-can-eat model, to the era of buckets based on volume, to today with personalized and more targeted offerings.

With all of these models, the service provider is offering connectivity, billing and consumer packaging directly to its end-users, which the application and device dimensions use to build from. The network is not part of the user solution, and it is seen simply as a 'black box' when applications are developed or devices launched. As these broadband models are not tied to a specific service, developers are using the network as a platform on which to deliver their applications or devices.

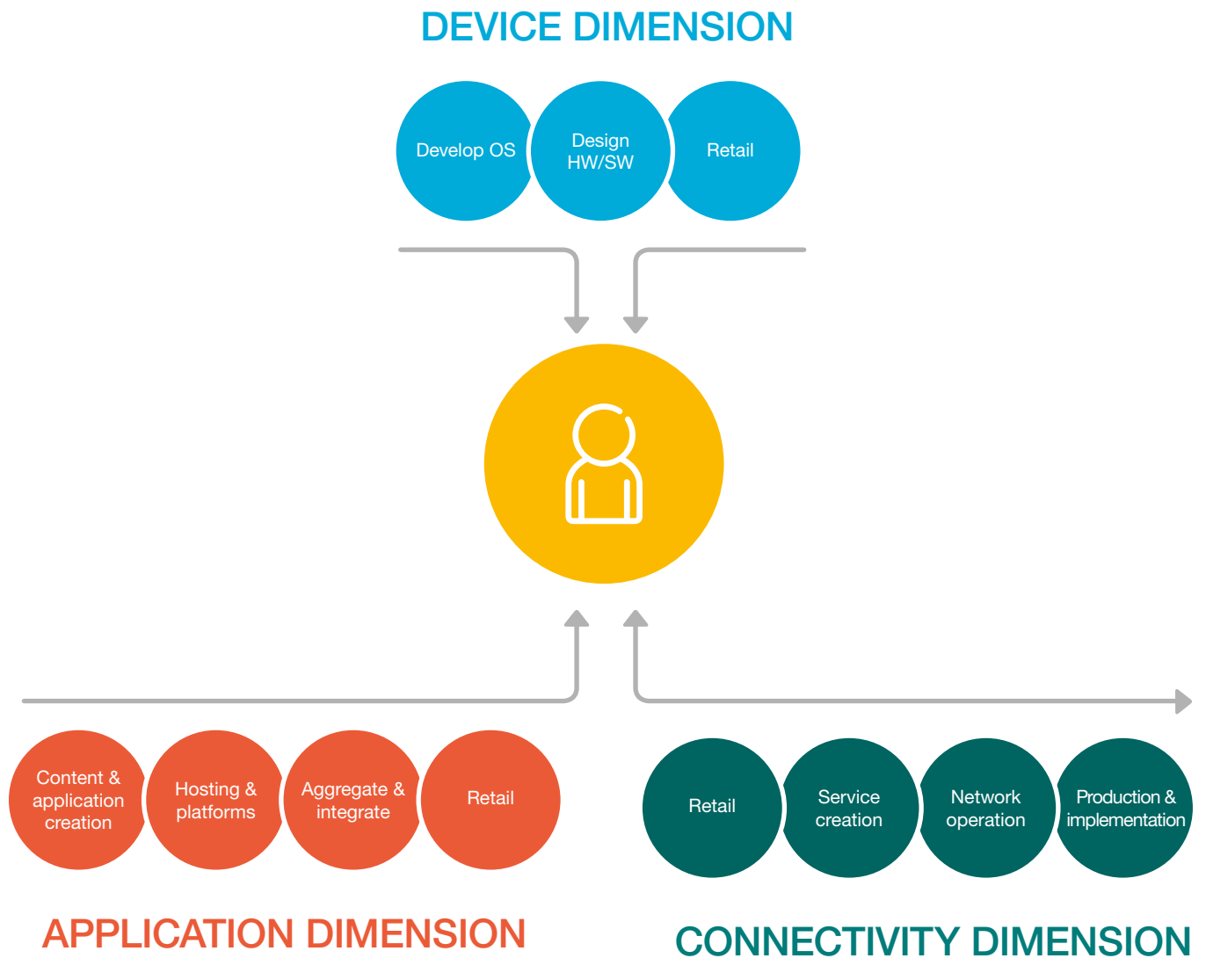Naturally, this does not include the service providers' legacy services.

The service providers' core business and position in the ICT value chain has mainly become a provider of connectivity, a position which is strong and largely unthreatened today. The next step is defending this position, and using it to develop stronger relevance and increased value capture in the ICT industry.

With the demands of the Networked Society, an increase in mobility and higher reliance on connectivity, we believe the next phase is differentiated connectivity. A programmable network will enable service providers to achieve differentiated connectivity, and stronger connections to the services that run on the network. Differentiated connectivity and exposed network capabilities open up new possibilities for collaboration within the ICT industry.

A growing number of applications will reside in the cloud, resulting in a requirement for much stronger relations with the network.

CHANGING THE ICT VALUE CHAIN

Figure 1: The ICT value chain

DEVICE DIMENSION

Develop OS

Design HW/SW

Retail

Content & application creation

Hosting & platforms

Aggregate & integrate

Retail

APPLICATION DIMENSION

Retail

Service creation

Network operation

Production & implementation

CONNECTIVITY DIMENSION

Differentiation requires programmability
Differentiated connectivity and network usage will create unique opportunities for individual use cases, allowing applications and businesses to leverage capabilities and values enabled by their service provider.

Networks will have to be more programmable than they already are, and the introduction of new and emerging technologies, such as Software-Defined Networking (SDN) and Network Function Virtualization (NFV) will help to develop this.

Programmability will lead to networks that are not only aware but also adaptable, able to create possibilities to expose capabilities and data to users, partners and third parties.

Programmable networks are a tool box, enabling the network to become a platform used for value creation.
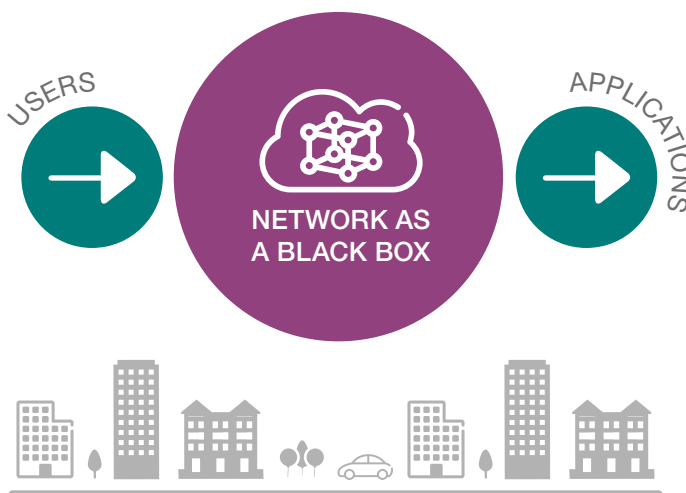
A CHANGING RELATIONSHIP

The move from competitors to partners

Over the last decade there have been substantial changes in the application and device dimensions. The number of applications has grown tremendously, as has ownership of smartphones and tablets. Strong collaboration between the two industries has led to the formation of dominant ecosystems such as Apple and Google, with strong relationships to the end user.

The growth has occurred on these platforms within the eco-systems, based on open innovation on top of open platforms. Developers are delivering their services on top of the network, hence the term OTT players. The majority of OTT players see the network as a 'black box', with no direct relation to it. Advantageously, services can be delivered over any network without any customization or integration. However, OTT players do not have full control of the user experience, as this depends on the network performance.
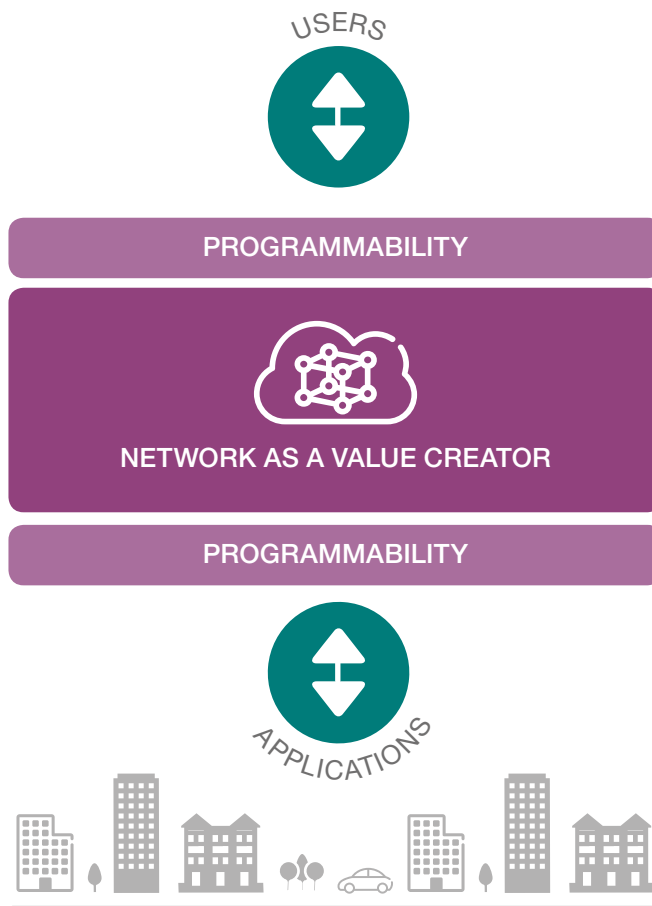
BEING PARTNERS

is an essential step for service providers, device manufacturers and application developers, instead of competitors

Programmable networks represent an opportunity to move the network dimension closer to the device and application dimensions, becoming an important contributor to value creation and an integral part of new and existing ecosystems.

Demands for excellent customer experience are increasing, as are applications that require more than 'best effort' connectivity, meaning a complementary model will have to emerge. With programmable networks and differentiated connectivity, new services and business opportunities can be explored. Service providers, device manufacturers and application developers will have to move from being competitors to being partners.

It was often predicted that the introduction of television would cause the death of radio. However, reality has shown this was not the case – rather the opposite. In the same way, the OTT-model will continue to thrive going forward, with complementary models addressing new and more advanced needs.

Figure 2: The traditional OTT model

USERS

APPLICATIONS

NETWORK AS A BLACK BOX

Figure 3: The network as a 'toolbox'

USERS

PROGRAMMABILITY

NETWORK AS A VALUE CREATOR

PROGRAMMABILITY

APPLICATIONS

BIG
OPPORTUNITIES

Roles for the service providers in ICT

Service providers will have to make strategic choices, and choose from three principal ICT roles. These roles are not exclusive, and service providers will be able to choose between different strategies for different market segments.

NETWORK DEVELOPER
Network leadership

Focuses on the core connectivity business by ensuring excellent network performance and application coverage, with personalized offerings and partnerships.

SERVICE ENABLER
Enables end-to-end

On top of a great connectivity offering, a platform for the exposure of network capabilities and data is created for partners and third parties.
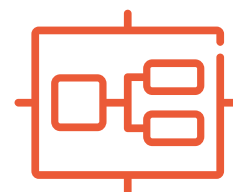
SERVICE CREATOR
Accountable for experience

Uses network capabilities to create differentiated end-to-end services under their own brand. Services are sold directly to the subscriber and complete responsibility for user experience is assumed.

Financial impacts

The world has moved from singular use cases (voice calls/SMS) to a reliance on the network for a wide variety of uses. While some will work fine on 'best effort' connectivity, some will not.

The World Bank has estimated the industrial internet's global market size to be USD 32.2 trillion – equaling 46 percent of the global economy. The Industrial internet[1] covers fields such as machine learning, big data, Internet of Things (IoT) and machine-to-machine (M2M) communication.

To give an example of how programmable networks could impact industry, General Electricity (GE) has calculated that a one percent reduction in fuel consumption of commercial jets through the use of ICT would lead to savings of USD 30 billion over 15 years. Fuel saving would be achieved through downloading large volumes of engine data for analysis and uploading optimized engine settings as soon as the plane lands.

The parts in a network do not have the same value, so high worth use cases will be an attractive business opportunity for the ICT value chain.

[1] The industrial internet is a term founded by General Electricity (GE)

LEADING
THE WAY

The principles of programmability
In order for network programmability to be widely avaliable, the following key principles are important:

PRINCIPLES

OPEN

Exposed innovation on top of open platforms has been proven to outperform any other model. The use of network capabilities must be open and standardized to become attractive and competitive.

INDUSTRIALIZED

Network programmability needs to be easy to use and standardized. The level of integration will define the market size through the number of use cases that can support the cost of integration.

BUSINESS FOCUSED

Network programmability needs to come with a clear idea about how it should be used commercially. For the exposure of network capabilities a clear and transparent framework must be established.

EXAMPLES OF EFFECTS

COST EFFICIENCY

Simplification of the networks will lead to reduced cost and better through reuse of infrastructure.

TIME TO IMPLEMENTATION

Network programmability and industrialization leads to reduced time-to-market

FLEXIBILITY

The network becomes a platform where many different things can be built on top of one single infrastructure.

There is much debate about how programmability is created. Emerging technologies such as Software Defined Networking (SDN) and Network Function Virtualization (NFU) will play an important role in increasing the possibilities of programmable networks. However, an end-to-end view of the network, and its evolution, within the context of the transforming ICT value chain is necessary for creating a complete solution.

Figure 4: Programmable networks: a tiered architecture

1 EXPOSURE

Allows for external applications to use the network and connect with it in a simple way.

2 PREFERENCE

Keeps track of how a specific consumer should be treated given a specific context.

3 POLICY

Contains the rules on how different situations and customer roles should be treated, and sends instructions to the execution layers. It is crucial that the policies applied in this layer are maintained and organized in a centralized manner.

4 EXECUTION

The technical infrastructure in the networks needs to be dynamic so it can adapt and change to certain conditions, and execute orders from higher up in the hierarchy.

NETWORK DIFFERENTIATION TODAY

Network slicing: the visualization of differentiation

A programmable network can be visualized as one network where individual slices are created for different use cases. Essentially, network slicing divides a single physical network into multiple virtual versions. Instead of physically building several different networks to support varying use cases, programmability can be used to create virtual networks with numerous capabilities that a range of industries can tap into.

Figure 5: Visualizing network slicing

1 THE SELF DRIVING CAR
Very high demands on connectivity as it is critical to not have an accident.

2 STREAMING ENTERTAINMENT
Connectivity is not as critical as with the self-driving car, but as a real-time service, it is still important.

3 DOWNLOADING OF DATA
Not time critical. Downloading of updated software can be scheduled for off-peak hours.

The change has started

There is already a lot of programmability available in networks today, for example in the Policy domain. Though it has been available for some time, it has not been explored to its full extent. Contributing factors can probably be found among lack of industrialization, and need for collaboration with new partners.

However, programmability is being used today. Leading service providers are successfully experimenting with differentiated connectivity, while innovative business models are gaining importance with the disruption in the ICT value chain.

> **Limited connectivity**
> Entry and low-cost packages are created based on different limitations. For example, use cases are appearing with subscriptions to one application only. Network programmability is used to analyze the traffic, and permitted traffic is passed through, while all other traffic is blocked.

> **Zero rating**
> Differentiated offerings are created based on free access for specific traffic.

Examples of this include time-limited specific sports events, where traffic is not charged.

Other examples include the way network programmability is being used to create differentiated services, which are proving commercially successful.

Scope for the future

Through programmability, the network dimension can become an even more potent contributor to value creation. With macro trends like the cloud and mobility, connectivity will play a central role in the transformation of the ICT value chain.

A network differentiated by programmability has the ability to disrupt the ICT value chain, taking a much more dominant and user orientated role. Able to distinguish between users, devices and needs, the programmable network can offer high value connectivity to high value use cases, and best effort OTT where relevant. Transformation is key: dimensions must be partners, not competitors; processes will adapt and be opened up; business models should be disruptive and innovative, in order to take full advantage of differentiated connectivity.

Ericsson is the driving force behind the Networked Society – a world leader in communications technology and services. Our long-term relationships with every major telecom operator in the world allow people, businesses and societies to fulfill their potential and create a more sustainable future.

Our services, software and infrastructure – especially in mobility, broadband and the cloud – are enabling the telecom industry and other sectors to do better business, increase efficiency, improve the user experience and capture new opportunities.

With more than 110,000 professionals and customers in 180 countries, we combine global scale with technology and services leadership. We support networks that connect more than 2.5 billion subscribers. Forty percent of the world's mobile traffic is carried over Ericsson networks. And our investments in research and development ensure that our solutions – and our customers – stay in front.

Founded in 1876, Ericsson has its headquarters in Stockholm, Sweden. Net sales in 2013 were SEK 227.4 billion (USD 34.9 billion). Ericsson is listed on NASDAQ OMX stock exchange in Stockholm and the NASDAQ in New York.