Scalable network opportunities

An economic study of 5G network slicing for IoT service deployment

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New services, new approach

Mobile data traffic is growing at a rapid pace. In addition, there will be an estimated 18 billion Internet of Things (IoT) devices by 2022, meaning there will be an even greater increase in demand for data.[1]

The era of IoT has the potential to transform industry and society and, with 5G on the horizon, there are unlimited possibilities for new business models. In order to handle this huge amount of IoT traffic, networks will need to adapt.

IoT can be segmented into Critical Machine Type Communication (C-MTC) and Massive Machine Type Communication (M-MTC) services, representing a range of use cases with varying connectivity requirements. C-MTC services, such as remote surgery or cloud-controlled robots in a factory, are typically characterized by ultra-low latency, high reliability and high throughput, but are relatively small scale. M-MTC services, such as smart city sensor grids or vehicle tracking fleets, are large scale but have low throughput. These services open new business opportunities for operators and industries, but come with complex and diverse challenges.

Operators will need to invest in new technologies to address the demands of these new service deployments, if they are to make the most of the potential value that can be generated. One solution is network slicing, which allows operators to segment the network to support particular services and deploy multiple logical networks for different service types over one common infrastructure.

Despite extensive industry discussions on network slicing, we are unaware of any other economic study that quantifies the benefits of this technology.

Ericsson, therefore, partnered with UK operator BT to investigate what economic impact network slicing could have. Over four months, Ericsson and BT performed an economic delta study comparing network slicing with two alternative scenarios for new service deployments, which we termed "one big network" and "separate specialized networks". We evaluated the benefit of network slicing in terms of its incremental contribution to operator's revenue, opex and capex, which we refer to in the following graphs as "contribution".

Our research question: What is the economic case for deploying new services using the following three scenarios?

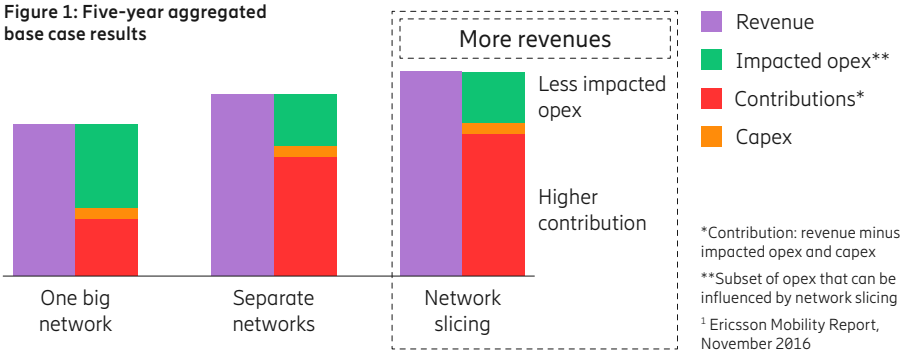
1. One big network to carry all service types
2. Separate specialized core networks for each service type
3. New network slices per service type

The result of this delta study is a techno-economic model that takes into account the main value drivers behind new service deployments, which have an impact on revenue, opex and capex (e.g. time-to-market), operations and cost of deployment, where efficiency factors vary between scenarios. The delta study compares the benefits of deploying new services using (core) network slicing versus the alternative approaches of one big network and separate networks.

Though it is recognized that network slicing can extend end-to-end across the radio and transport network domains, this study was restricted to evaluating the impacts of network slicing in the core network only.

Network slicing provides the greatest economic benefit

Figure 1: Five-year aggregated base case results



*Contribution: revenue minus impacted opex and capex

**Subset of opex that can be influenced by network slicing

[1] Ericsson Mobility Report, November 2016

Key takeaways

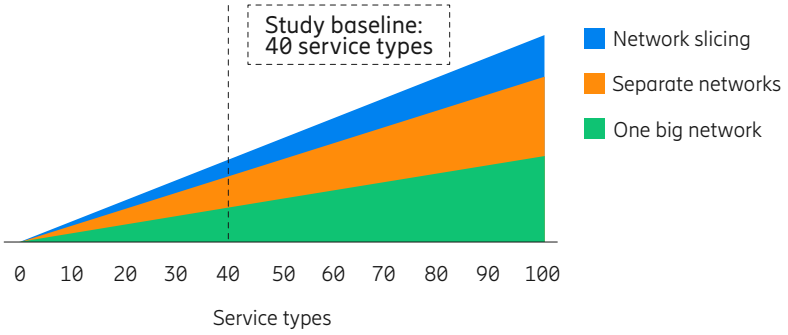
- Network slicing results in new revenue generation, lower opex and greater capex efficiency
- The new service launches enabled by network slicing result in significant incremental contributions to the bottom line
- Assuming cost-efficient deployment of slice orchestration automation, network slicing is the most economical way to achieve service scalability
- Economic benefits will rise in line with the scale of additional services
- Opex results in the case of network slicing are positively impacted by the assumed investment in automation of network slice orchestration

Methodology

The study examined capex, impacted opex and revenue consequences of new service introductions across three scenarios. We wanted to remove the economic impacts of virtualization so that the common baseline (starting point) for each scenario was a virtualized core network. It also assumed that a mobile broadband service has 25 million subscribers on the network. The study ramped up to 40 unique service type launches per year, each requiring different network design and validation efforts. This included a steady mix of 60 percent C-MTC and 40 percent M-MTC services. A rough assumption of a network slice orchestration investment over three years, to manage the complexity of a large number of slices through automation, is included.

Network slicing already shows a benefit with a few service launches compared to other scenarios

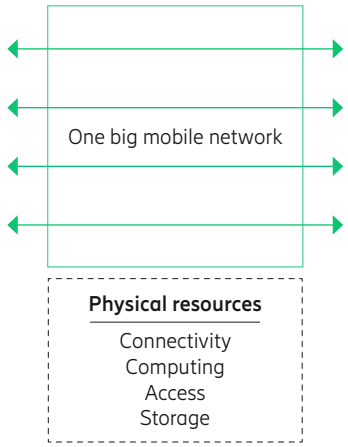
Figure 2: Five-year contribution* of annual service launches



Study scenarios

One big network

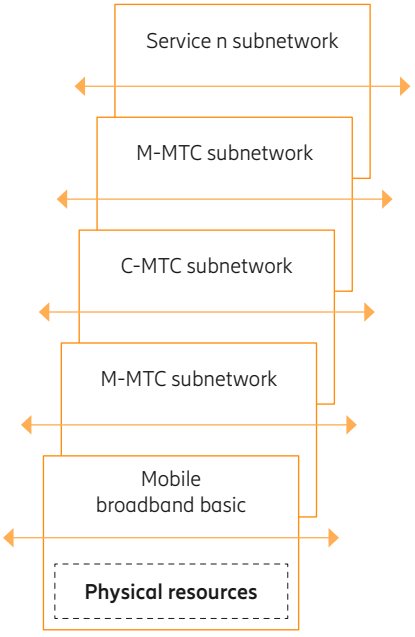
A single multi-service network



— **Shared functional layer**
— **Shared physical resources**

Separate networks

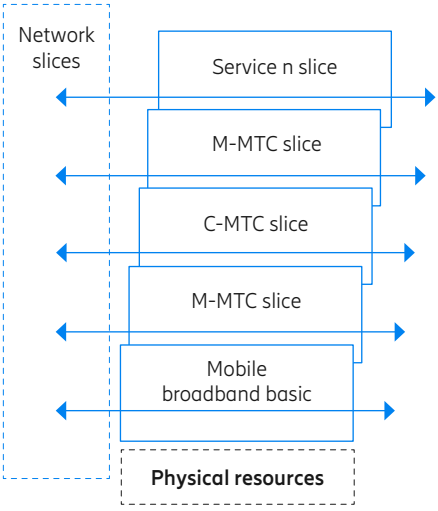
Individual networks with dedicated resources



— **Dedicated functional layer**
— **Dedicated physical resources**

Network slicing

Multiple logical networks on top of a common shared physical infrastructure



— **Dedicated functional layer**
— **Shared physical resources**

Significant revenue contribution

The aggregated results of the study were based over a five-year period. By comparing revenue, impacted opex and capex components for the different scenarios, we calculated the resulting comparable contribution. The delta between each scenario's contribution represents the economic benefit of network slicing.

The study found that incremental revenue generated from new service introduction in the network slicing scenario was 35 percent more than in one big network. When compared to separate networks, network slicing contributed 15 percent. When comparing with one big network or separate networks, the potential impact on revenue proved to be the greatest benefit of network slicing, followed by opex savings.

Revenue impact

Revenue is impacted by network slicing because the technology enables market stimulation, faster time to market, and opportunities from smaller niche services. However, if the required ecosystems are not in place, or there is no market demand, then the value of network slicing will diminish. This means that marketing and pricing will need to be effectively coordinated in order to launch compelling services that will drive uptake.

— **Market stimulation**
Network slicing improves business flexibility through personalized Service Level Agreements (SLAs) and billing. Automation also enables faster customization, self-service and scalability. This in turn enhances service performance, as well as customer experience and satisfaction. The result is greater service uptake and higher ARPU.

— **Time to market**
Network slicing, if underpinned by the appropriate level of automation, enables isolation during the service deployment process and reduces interoperability testing effort, allowing faster service launches.

— **Smaller opportunities**
Through network slicing, it becomes economically viable for operators to explore long tail niche services which will provide direct and indirect value; for example, through sandboxing, temporary events and tailored business models.

Impacted opex savings

Shorter service delivery cycles and simplified operations mean operators can reduce impacted opex with network slicing. They also ensure effective design and verification for designing new service types. However, there is less operational benefit when comparing network slicing and separate networks, as the latter assumes the use of dedicated hardware, as opposed to shared hardware.

— **Streamlined processes**
Network slicing improves operations as there are fewer cross-dependencies between functions supporting different slices and service types.

— **Tailored operations**
Flexibility and isolation ensure operations can be customized to the service type.

— **Easy instantiation**
Real-time instantiation of network functions and network slices enables resource optimization.

— **Less effort**
If the right level of automation for network slice orchestration is deployed, and this is cost-effective, network slicing can significantly reduce full time equivalent staffing needs when scaling the number of slices.

— **Minimized risk**
Network slicing enables isolation between services, ensuring protection from other network service disruptions at the functional layer.

Capex avoidance

Network slicing is capex neutral compared with other scenarios. Although network slicing itself is more capex efficient than other network scenarios as a result of infrastructure efficiency, this benefit is offset by the necessary investment in automation needed to mitigate the resulting additional network complexity.

— **Infrastructure efficiency**
Network optimizations can be made with slicing, due to the implementation of an efficient traffic model with service type segregation. Functions in network slices are dynamically scaled according to traffic/service demand. Separate networks will have greater overheads for dimensioning compared to network slicing as it is assumed that capacity adjustments will involve a manual planning cycle.

— **Better resource utilization**
Each network slice distributes resources based on the complexity of the service, such as bandwidth or latency demand.

— **Reduced integration scope**
The isolation of network slices reduces the integration and interoperability testing of service and network functionality.

Rapid payback

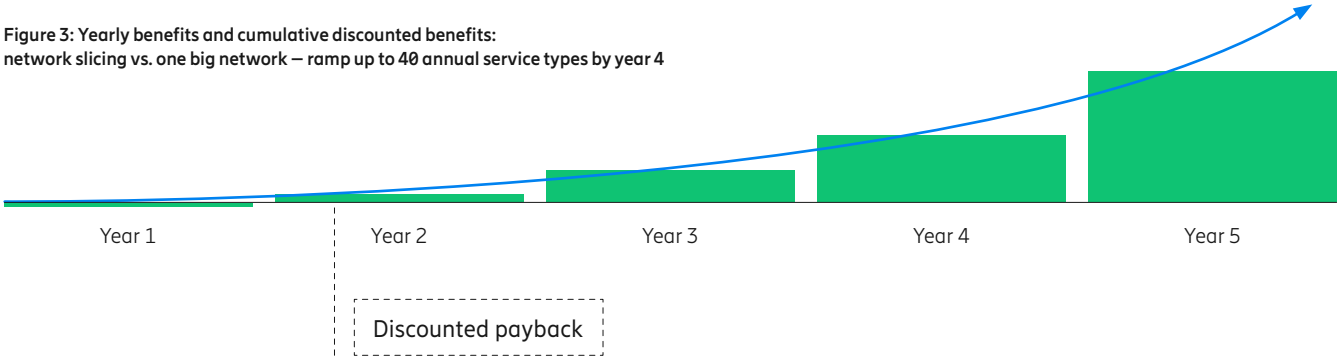
The initial automation investment in network slicing orchestration for managing the complexities of many slices can potentially be returned quite quickly.

We assessed the yearly and cumulative discounted benefits of network slicing compared to one big network. Digital disruption in multiple industries will drive an explosion in new services and business models. Therefore in our study, we considered the impact of ramping up to 40 new service launches by year 4. The study showed that investment in network slice orchestration is paid back in one to two years if a high number of service launches is assumed.

We also investigated the corresponding results when reducing the number of services from 40 per year to 5. We found that operators would still see discounted payback within three years compared to one big network. This shows that even with a small number of services, there is a low risk of investment considering the benefit of a flexible, scalable network. It should be noted that if the anticipated number of service launches per year were as low as five, then the level of investment in network slice orchestration would be scaled back accordingly.

Investment in network slice orchestration is paid back

Figure 3: Yearly benefits and cumulative discounted benefits: network slicing vs. one big network – ramp up to 40 annual service types by year 4



Benefits scale with services

Investment in network slice orchestration is a prerequisite for network slicing in order to manage a large number of slices. We have already seen that this can be returned in a short time period. The study has also shown the economic benefits enabled by network slicing.

As flexibility is a core feature of 5G, it is the scalability of this scenario that makes it truly stand out as an innovative business model. When comparing network slicing with separate networks, we found that there are benefits from deploying five or more service types per year. Benefits can already be made from the initial service launch on network slicing compared to one big network. These increase dramatically with the more services that are brought to market.

Our base case results reflect a ramp up to 40 annual service launches during 5 years. Results show that the more services operators deploy with network slicing, the greater the economic benefit they stand to gain.

Network slicing vs. One big network

35%
Increase in revenue

-40%
Impacted opex

150%
Total economic benefit

The most viable option
By comparing slicing with alternative network deployments, Ericsson's study with BT found a significant economic benefit of network slicing on 5G networks.

This economic benefit is based on two assumptions: the appropriate level of automation for network slice orchestration is deployed to support network slicing and service creation at scale, and a significant step change in the number of service launches planned and executed by operators per year. Impediments to this that are beyond the scope of this study will need to be addressed as well.

Network slicing enables an ecosystem that is the most viable option for deploying multiple and diverse IoT services across a broadening range of customers, each with their own business needs.

The greater the number of slices, the more economical the model becomes, providing operators with extensive opportunities to increase revenue and make cost savings.

As applications for technology become ever more complex, so will their connectivity characteristics. Network slicing provides a logical set-up that can be tailored to these applications and, as a result, enables fast delivery of new services.

Many industries will benefit from a segmented network that can maximize flexibility to support different needs. If operators are to meet these changing demands, they will need to embrace network slicing and its increasing potential for future opportunities.

> Network slicing enables the most economical model for IoT service delivery

Benefits of network slicing

- Better customer experience
- Cost-efficient management of service types
- Shorter time to market
- Simpler resource management
- Scalability through design and verification
- Flexible network

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