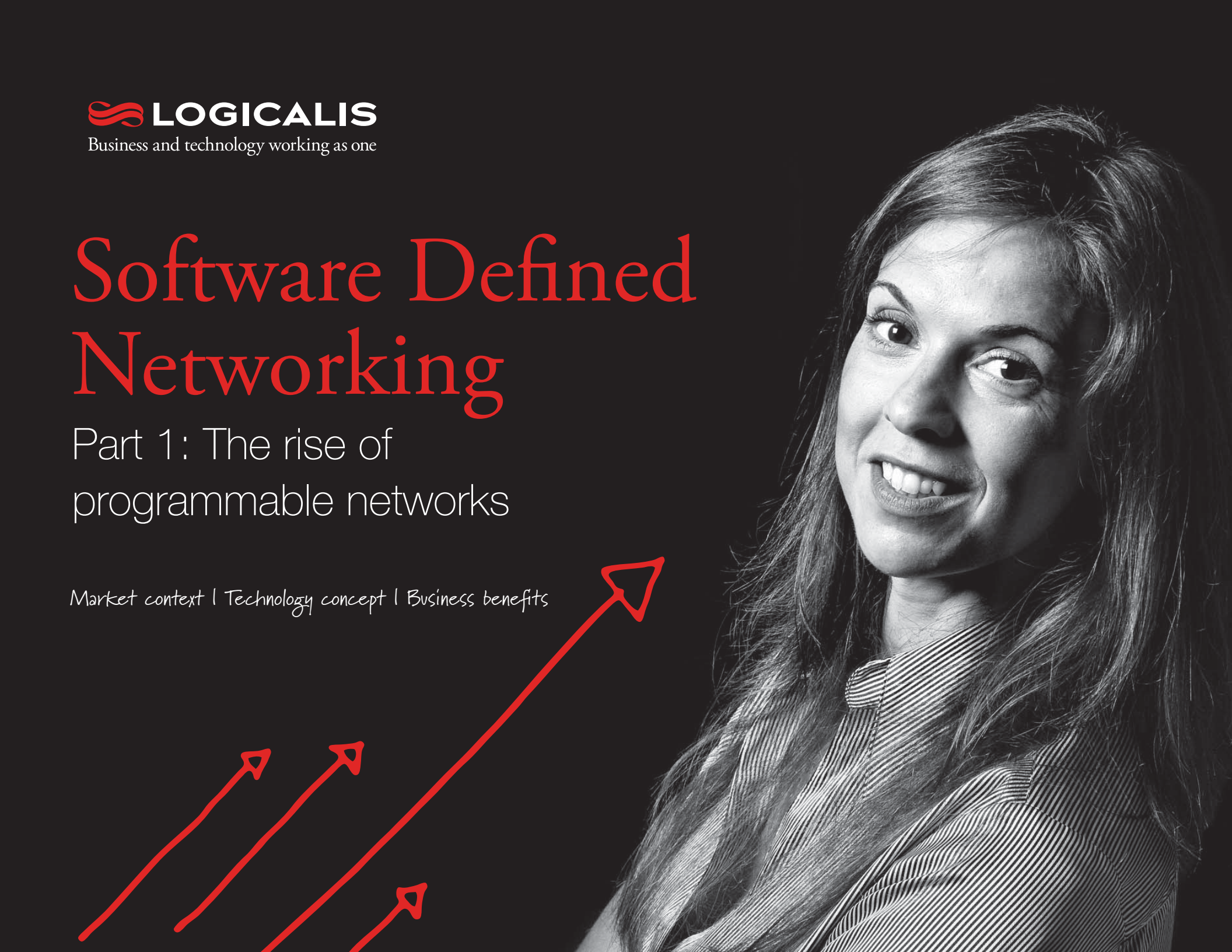
LOGICALIS
Business and technology working as one

Software Defined Networking

Part 1: The rise of programmable networks

Market context | Technology concept | Business benefits



In summary:

As IDC points out, the emergence of Software Defined Networking (SDN), and network virtualisation has the potential to underpin and enable a fundamental transformation in the way businesses and technology interact.

It is no exaggeration to say that SDN represents the most significant transformation of networking architecture and technology since the 1950s, but its impact will be felt far more widely.

SDN will play a fundamental role in enabling the emergence of the services defined enterprise and, by extension, the transformation of IT departments into internal enterprise service providers.

Based on the work of an international research group drawn from across the Logicalis organisation, this paper:

- Outlines the market context that has driven the development of SDN
- Explores the SDN concept as it is currently understood
- Assesses some of the common benefits that businesses can expect to accrue from a move toward SDN

"SDN offers the potential to cut costs as it increases the ability to create new applications and services, enable virtualisation, and share networks. Thus, current operational costs and future capacity requirements can be reduced. In addition, enterprise IT can roll out services more quickly as it transforms from a cost centre into an enterprise service provider."

– IDC MarketScape: Western Europe Network Virtualisation Solutions 2013 Vendor Assessment

Market Context

The information and communication technology market is undergoing a moment of transformation.

The growth in mobile devices and social networks, the increasing adoption of cloud computing and, in the near future, the massive use of intelligent sensors in various devices connecting virtually anything to the network are all changing the way people, businesses and societies operate.

But this change brings new challenges. In all of these transformations, the network is the common denominator. It is the binding agent, and its critical role in enabling a new world of hyper-connectivity for people, businesses and governments is now under scrutiny.

Legacy Architecture

While the world of technology continues to advance, the network in most of its applications represents an architecture based on concepts born in the 1950s; the 1990s and 2000s brought impressive strides forward in the speed of networks, but this was mirrored by only incremental improvements in network intelligence.

As a result, current network architectures are robust and powerful enough to support most current use-cases, but limitations in their physical scalability and operational effectiveness pose a significant risk to innovation in enterprise technology and in the emergence of a new, hyper-connected world.

A New Model

Responding to this challenge, manufacturers, researchers and standards bodies have embarked on a new model for network architectures.

Based on open standards, it aims to drive efficiencies in efforts to increase network scale while reducing complexity—and to increase the flexibility and speed of resource deployment while driving down the cost of complex network deployments.

The result of this work is Software Defined Networking or SDN.

Technology Concept

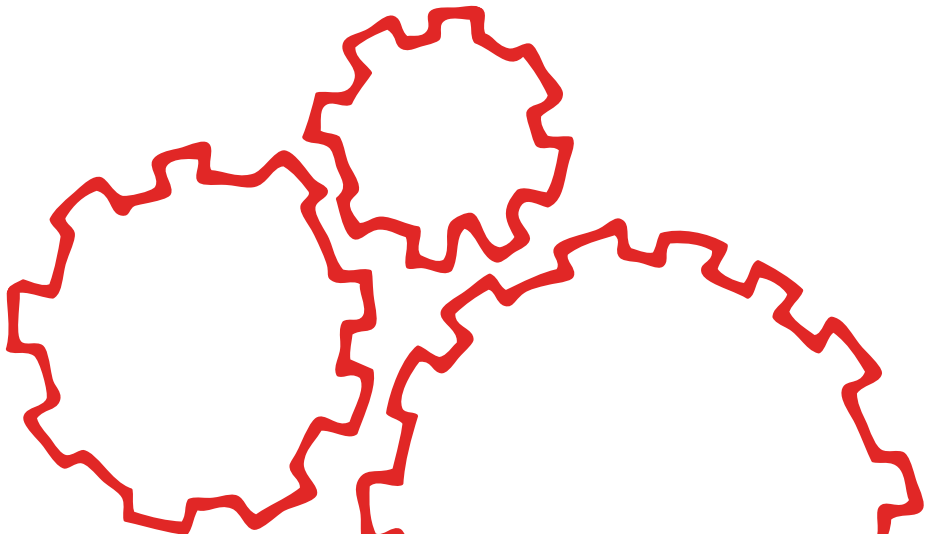
SDN is an architecture that foresees the abstraction of network control and data planes.

- The software responsible for defining a routing process, security policies, traffic engineering and data plans, is separated from the data plane, the actual forwarding of the packet.
- Network elements are responsible only for physical package routing, while all routing control is through software at what could be called the “intelligence layer”.

As the intelligent layer is decoupled from the physical network forwarding layer, the decision-making process can now be distributed to many more systems, and resources can be driven throughout the network at greater speed and with greater flexibility.

This is similar to a concept now deployed in cars where the engine management system is separate from the physical engine itself. The engine still provides the horsepower and turns the wheels, but the engine management systems decide in real-time how those wheels are turned, something which dramatically improves driver experience, safety and vehicle efficiency.

But SDN goes one step further. SDN is the engine control system not for a single car, but for an entire fleet of cars.



The Programmable Network

SDN will create networks that are less complex to operate but are more flexible and agile than ever before.

- Traffic policies can be quickly refined as business demands change, all without the need to individually configure switches and routers.
- Applications can directly interact with network resources, and the infrastructure behavior can be automatically defined according to the applications needs.
- Virtualisation becomes as ubiquitous in the network as it is within the data centre, turning a relatively basic ‘big pipe’ into an intelligent resource that can be applied and redeployed in an instant.

Intelligent and Business Orientated

In the SDN model, network elements (routers, switches, firewalls, etc.) will be driven by APIs (Application Programming Interface) in the operating system. This will allow any applications developed by a network vendor or a mobile application vendor to interact with the system’s control plane, making traffic engineering decisions based on much more than just the physical device’s MAC, IP address or basic CoS or QoS metrics.

In the new world, decisions could be made on information and business requirements as abstract as the SDN model itself including temperature, link cost, energy consumption or practically any business driver.

With SDN, the programmable network is born.

One of SDN's foundation initiatives is the OpenFlow protocol, proposed as an open and universal language for the "communication" between network elements and the creation of dynamic flow tables. Many devices being shipped today are already compatible with OpenFlow, making the protocol the bed-rock of SDN's expansion.

As an OpenFlow alternative, in 2013 several manufacturers created the Open DayLight association. Sustained by the Linux Foundation, it's a collaborative project with an ambition to create a standardised network controller (element in the control layer), thus avoiding protocol and network software fragmentation, a major concerns when it comes to open and programmable networks.

The Unscalable Human "Middleware" in Legacy Networks

Human intelligence seems to know no bounds, but human productivity is not infinite. It is the constraint of human resources that has most limited the agile provisioning of resources within IT, with most provisioning or change management still being performed through human interaction.

Historically, this has not been a major issue. Networks, and the devices on them were fixed, usually to desks, and the applications operating across them were homogenous in their requirements. Changes to the network were infrequent and usually part of a larger change project.

Now, the network is supporting an ever more dynamic range of devices, most of which are now mobile, as well as a growing set of dynamic applications, and services that push demanding network requirements to every port. All of this is also now combined with a changing set of access and security needs, traffic priorities and quality requirements.

Homogenisation must now make way for personalisation.

SDN offers scalable organisational, line of business, or individual personalisation of resources; without having to scale the organisation that delivers these new adaptive environments.

As a result, SDN brings a double win; massive adaptability requiring fewer resources than today's fixed networks.

Source: HP

In a world where the network connects everything and everybody and where dynamism in adds, moves and changes is moving from a 24-hour SLA to real-time, the promise of SDN is a truly adaptable environment that can be manipulated or that can manipulate itself in an instant.

Business Benefits

SDN promises to unleash a wealth of business benefits; perhaps the most significant of those is the role it will play in enabling the emergence of service-defined enterprises.

Specific benefits depend on use cases, industry and individual applications, though there are a number of outcomes that are likely to be universally beneficial, including complexity reduction, centralised and more granular control, improved application experience, and advances in availability, reliability and security.

Complexity Reduction

Abstracting the control of the network from the physical infrastructure breaks the link between human control and network control.

This both removes complexity and improves response times to changes to the profile of the network, whether that is provisioning new services in the data centre, provisioning new services across a WAN, or the direct application orchestration of real-time network resources.

SDN is a move from a manual to an automated environment, an improvement which will increase the physical speed of resources infinitely while delivering consistent performance as scale grows. With a dramatically simpler infrastructure model, it is easier to improve operational agility, reduce operational costs, and re-assign specialist resources away from mundane tasks.

Centralised and More Granular Control

SDN brings expansive networks under a centralised control, moving the programmability of homogenous networks from different vendors back to a central point. It also moves network control from a linear model of macro control to much finer and nuanced policy implementations.

The combination of these two characteristics ensures the ability and flexibility of networks based on the new architecture. Central decisions can be made and implemented, and those decisions can accurately direct resources and network profiles to create subtle changes that can deliver significant characteristic improvements. SDN also levels the playing field for the underlying networking infrastructure, bringing together infrastructures that are currently independent and turning them into a singularly controllable network.

This is true even in complex environments such as the data centre where LAN, WAN, firewall, and load balancing resources may come from different vendors. SDN treats them simply as programmable resources, stitching them together at a control plane and allowing them to be directed as one. SDN also addresses one of the main issues in traditional network architecture—the need to "pile up" protocols created to meet different demands.

When making a change to large infrastructures, a new inter-woven configuration is necessary for each element changed, and it is up to the operational team to ensure that configuration X works seamlessly with configuration Y. With software defined networks, it is possible to replace some of the protocols that operate in "pile up" mode, thus creating a more efficient routing environment.

Improved Application Experience

One of the most celebrated characteristics of SDN is its ability to create intelligent responses to business demands. With simpler configuration and centralised control, network administrators can align infrastructures directly to specific application or end user needs.

Network environment virtualisation also allows the establishment of scalable and flexible traffic policies–based on the direct requirement of each individual application, allowing application changes or new deployments to be directly reflected in the network layer.

As a result, the network acts and responds to the needs of applications in real-time, which results in a better user experience, or reflects an abstracted decision-making process such as the cost of WAN bandwidth during a video call or the need to route an application through a specific security environment.

SDN Key Innovations: Programmable at Application and Virtualisation Level

1. Data and Control plane abstraction – Deterministic behaviour, predictable performance, quick convergence
2. Flow-oriented data plan – Simplified planning, global optimisation, offline analysis
3. Centralised control and management – Multi-tenancy and infrastructure sharing
4. Hardware virtualisation and abstraction – Truly tunable resources and improved performance
5. Programmable networks – Application-oriented networking

Source: ADVA

Availability, Reliability and Security

SDN architectures significantly improve the availability, reliability and security of network environments by eliminating the need for manual interventions and individual device configurations.

Most outages of IT resources are caused by physical hardware failures or manual configuration errors, and most security flaws to IT systems are caused by incorrect configuration of firewalls, routers or other security resources.

In SDN, while the human operator will set policy decisions, the SDN control plane executes the changes to the network in what should be a more consistent manner, and one that is less dependent on any specific intervention by a human operator.

Conclusions

Given the pressing need to move beyond legacy networking architectures and the wide-ranging benefits SDN promises to deliver, it is easy to see why the market for SDN is expected to grow rapidly.

IDC research shows that the SDN market is currently in its infancy, with product sales of approximately US$360 million worldwide. However, it is expected to reach US$3.7 billion by 2016, with 58 percent of this investment related to data network control and infrastructure hardware and software.

It is therefore not surprising that all major ICT infrastructure vendors are already designing strategies and positioning themselves in the SDN market. And, with SDN predicted to become a major force in just the next two years, the market is creating many new startups that either hope to drive the market or form part of some larger vendor's SDN strategy.

Software defined technologies are going to change the game for our customers.

As every CIO looks to find a partner that can transform the way they define and provision agile IT services, it is gratifying that IDC considers Logicalis to be a partner both our IT and business stakeholders can trust.

We will continue to invest in the skills that SDN demands of a new kind of partner—one able to advise customers from business policy and IT service provisioning down through the layers of SDN that make it a true transformation technology".

Chris Gabriel
CTO
Logicalis Group

About Logicalis

Logicalis is an international IT solutions and managed-services provider with a breadth of knowledge and expertise in communications and collaboration, data centre and cloud services, and managed services.

Logicalis employs nearly 3,500 people worldwide, including highly trained service specialists who design, specify, deploy, and manage complex ICT infrastructures to meet the needs of almost 6,000 corporate and public sector customers.

To achieve this, Logicalis maintains strong partnerships with technology leaders such as Cisco, HP, IBM, CA Technologies, NetApp, Microsoft, VMware, and ServiceNow.

The Logicalis Group has annualised revenues of over $1.5 billion, from operations in Europe, North America, South America, and Asia Pacific and is quickly establishing itself as one of the leading IT and Communications solution integrators, specialising in the areas of advanced technologies and services.

The Logicalis Group is a division of Datatec Limited, listed on the Johannesburg and London AIM Stock Exchanges, with revenues of over $5 billion.

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