WHITE PAPER

Networking Skills in Latin America

Sponsored by: Cisco

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IDC OPINION

The success of technology innovation lies in the ability of companies, organizations and countries to develop, consolidate and grow the necessary skills to leverage the technology in their business. Emerging economies, and Latin America is no exception, have the challenge of mastering the necessary skills to operate their ICT infrastructure, while, at the same time, leverage technology for sustainable growth and for a more protagonist role in the global economic scene.

According to IDC's Networking Skills Model analysis, the demand for networking skills currently surpasses supply by over 470,000 FTEs (Full Time Equivalents). However, in essential network technologies, this gap trends to decrease slightly with time.

A robust network infrastructure is the basis for sustaining business operations in an increasingly demanding and competitive economy. Digital transformation is now at the center of the discussion in industry forums, and new and emerging technologies are the enabling factors of disruptive change affecting an increasing number of industries. Networking now is fundamental to a mobile-first, cloud based, complex applications landscape, and must be ready for the impending explosion of the Internet of Things (IoT). Supporting the new infrastructure will require the development of new skills and a rapid specialization path for professionals to master the new face of the network, while at the same time, leverage new business models, like cloud and outsourcing, which enable economies of scale, and give more efficiency to the traditional network operation. Latin America's success depends on its ability to leverage the same resources that were used to lower the skills gap in traditional networking skills, into ensuring the specialization of network technologies that sit at the center of innovation for the digital transformation of the business.

EXECUTIVE SUMMARY

There is an ongoing discussion about how the skills gap in specific areas of the ICT industry is a factor that inhibits the ability of companies to benefit from technology innovation for business growth and sustainability in the future. This conversation is especially important in emerging markets, such as Latin America, where the availability of skilled professionals usually lags behind the demand, fueled by growth.

In late 2007, and again in 2012, IDC developed a research initiative around the skills gap in various segments of the IT industry, which we are now refreshing in order to track and reflect new market developments. In IDC´s opinion, the nature of the skills gap in 2015 and beyond is very different from what was observed some years ago.

For this study, IDC conducted 760 interviews to employers in 10 countries in Latin America: Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Mexico, Peru and Venezuela. Interviews were segmented by vertical industry and size segments: government, education, healthcare, telecoms, financial services, manufacturing, retail and wholesale, media / broadcasting / publishing, travel / transportation / distribution, resources and services in companies with more than 100 employees. Respondents were selected based on their responsibility for network infrastructure and management of professionals involved in network design, operation & maintenance, deployment, and support. The interviews were conducted in the native language of the respondents (Spanish and Portuguese). To estimate the gap in networking skills, IDC designed a model that considered both ongoing IDC's research practices around networking and information technologies, as well as economic and social indicators. This is a complex model that combines these multiple data sources with the results from the interviews to provide and accurate view of the supply and demand of skills. This document intends to explore the results of this analysis in what IDC has dubbed "the evolution of the networking skills gap in Latin America". Under a scenario of transition in Latin America from a more traditional IT infrastructure to a technology platform for innovation, IDC was given the task of exploring the growth and demand of professionals in both areas: in essential (e.g., routing & switching) and in emerging technologies (e.g., IoT).

Based on the results of the survey and comparing the result obtained in 2012, companies continue to have a lack of skilled people with networking skills. This is a result of the following trends:

☑ Digital transformation is becoming pervasive, and there is an increasing awareness in all segments of industry, that technology transformation of the business is the key for business growth and future relevance

☑ Continuing demand for efficiencies within the IT infrastructure, with cloud lowering the barriers of entry for smaller companies to leverage technology in their business

☑ Proliferation of mobile devices as the main access point to the network. IoT as a potential driver for explosive growth

☑ Requirements for the network to support interactive (video), virtualized IT-supported business applications, and an increasing number of mobile apps

☑ Cloud or host-based networking across multiple enterprise technologies is becoming well established as a network and services offering

This gap represents a large proportion, 38%, of the total demand in skilled professionals for 2015, and remains large for the period of study. However, the networking skills gap is expected to trend towards a slight decrease in terms relative to the total skills demand. Some of the reasons for this decreasing trend are: more stable growth in the Latin America ICT market, government programs that are beginning to show results, economies of scale through cloud and outsourcing, and new products that enable operation efficiencies, among others. It should be noted that

even with this slight decrease, a substantial number of FTEs will still be needed throughout the 2015-2019 period.

The different types of networking skills assessed in this document include:

Total networking skills gap refers to the aggregation of essential and emerging networking skills. In 2015, IDC estimated a shortage of approximately 474,400 FTEs professionals across the Latin America region with this number slightly decreasing to 449,152 FTEs by 2019. These figures represent a skills gap (calculated as a proportion of total demand) of 38% in 2015 and 32% in 2019. The number of skilled people is based on IDC's proprietary skills model which calculates full time equivalents (FTEs) which are defined as IT professionals spending 100% of the time working with networking technologies.

In 2012, IDC estimated a shortage of approximately 139,800 professionals across the Latin America region with this number increasing to 296,200 FTEs by 2015. It should be noted that the current study considers the inclusion of more emerging technologies, such as cybersecurity, IoT, dig data and analytics, and SW development as an increasingly common activity for network professionals, providing a more complete picture of the networking skills gap in Latin America. It also includes two additional countries, Ecuador and Dominican Republic, that were not included in the 2012 study, and that provide additional insight from a country representing the Caribbean, and a country from emerging South America.

Essential networking skills. This refers to basic or core networking skills –such as basic router and switch skills, network security, wireless networking and VoIP and unified communications. It represented 45% of total FTEs skills gap in 2015 and will account for 38% in 2019. IDC estimated a skilled-people shortage of around 214,000 FTEs in 2015, decreasing to 170,420 FTEs in 2019. These figures represent a similar FTEs skills gap of 32% in 2015 and 24% in 2019, expressed as percent of demand on those skills. As a result of the combined efforts in industry and government, and new business models in cloud and outsourcing providing the basic network service, the gap in FTEs for essential technologies is closing at a Compound Annual Growth Rate (CAGR) of -6% from 2015-2019.

Emerging networking technology skills. This refers to skills in technologies such as video, cloud, mobility, datacenter & virtualization, big data, cybersecurity, IoT, and SW development, and represented 55% of total FTEs skills gap in 2015, growing to 62% in 2019. Within this group of skills, IDC estimated a FTEs shortage of skilled-people of around 260,300 FTEs in 2015, increasing to 278,732 FTEs in 2019. These figures represent a skills gap of 44% in 2015 and 38% in 2019, expressed as percent of demand on those skills. As these technologies ramp up and gain a stronger foothold within Latin American organizations, the demand for these skills will cause the FTE gap to slightly widen at a Compound Annual Growth Rate (CAGR) of 2% from 2015 to 2019. IDC assumes that education and government, as well as industry, focus their efforts in shifting efforts from emphasizing the development of basic networking skills towards a more specialized knowledge in new, emerging networking technologies.

Other Key Findings.

- ☒ **Non-technical skills.** The IDC study shows that non-technical skills are also an important element of the required skills for network professionals, as 85% of companies consider them to be either important or very important. Proficiency in English, team work, problem solving, creativity and innovation, and communication skills represent the most valued by companies. Even when project management and cross-technology skills are still considered as key, they are considered very important only by 35% of companies, relatively low when compared with English and team work, at 63% and 55% respectively.

- ☒ **Vendor certifications.** The role of vendor certification in hiring and developing network professionals continues to be very strong, and it represents a very important factor in 93% of organizations, representing an increase over 70% from the 2012 IDC study. 51% of companies considered vendor certification important and 42% very important. Companies also see a slightly diminished role, about 4%, of vendor certifications in the future.

- ☒ **Managed Services.** Outsourcing continues growing steadily in Latin America. This study shows that 26% of companies outsource a portion or all of their network operations. This varies significantly depending on the size of the company, with 19% of companies with more than 1000 employees with managed services in their networks, compared with 32% for companies with 100 to 250 employees.

- ☒ **SW development.** More and more, software is playing an increasing role in network technology. Mobility, Big Data, and new technologies such as SDN require that the network organizations take on proactive role in SW development to evolve and adapt the network infrastructure. Companies in Latin America are being proactive to this change, with 58% of interviewed companies having SW development as part of the functions on the network organization.

- ☒ **Cybersecurity.** In the wake of increasing cyber-attacks, companies are rapidly evolving from the traditional, perimeter focused security approach to a more robust cybersecurity framework. Latin America is no exception, with 86% of companies with a cybersecurity strategy. This number approaches 100% for companies with more than 500 employees. However, only 42% of companies include security and vulnerability management as part of a comprehensive cybersecurity strategy.

- ☒ **Women in networking.** Women continue making inroads into the technology careers, and this is also true for Latin America. On average, this IDC study shows that women represent 13.3% in network organizations in the region, with only 15.7% of companies with no women present in their network teams. In smaller countries, like Dominican Republic, Costa Rica and Ecuador, only about 5% of companies do not have women on their networking staff. However, with 31% of women enrolling in Computing Science and Engineering majors in the region (*2012, Source: UNESCO*), there is still much room for improvement.

- ☒ **Hiring and retention.** Hiring networking professionals continues to be a major issue in the region, with 62% of companies with difficulties in recruiting, citing as main reasons, the lack of the right combination of skills in candidates, as well as

the cost and the required level of the English language. More and more, companies are looking for professionals with almost no experience, and combining the hiring with training programs. 60% of companies follow this policy, as compared with 33% which recruit only fully trained staff. Retention is also an issue, with 53% of companies finding it difficult. Better salary offers in the market, lack of professional advancement and, to a lesser degree, issues with management and coworkers are the most commonly cited causes.

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METHODOLOGY

In the first half of 2016, IDC Latin America conducted a survey and combined it with a supply-side study to analyze the current status for both the demand and supply side of networking skills in 10 selected Latin American countries. The study provides an update to the one conducted by IDC in 2012. In addition to the previously measured essential networking skills, IDC has introduced an analysis of other technologies that, while enabling new capabilities and advantages introduce new challenges with regards to management, maintenance and support of the network. IDC has identified these as emerging networking skills including: Video, Mobility, Data Center Virtualization, Big Data and Analytics, Cloud and IoT (Internet of Things). As the market is rapidly evolving from a traditional approach to Cybersecurity, this was also introduced as part of the emerging networking skills. IDC also introduced SW Development, a skill that is increasingly required in network organizations as the role of SW in networking increases.
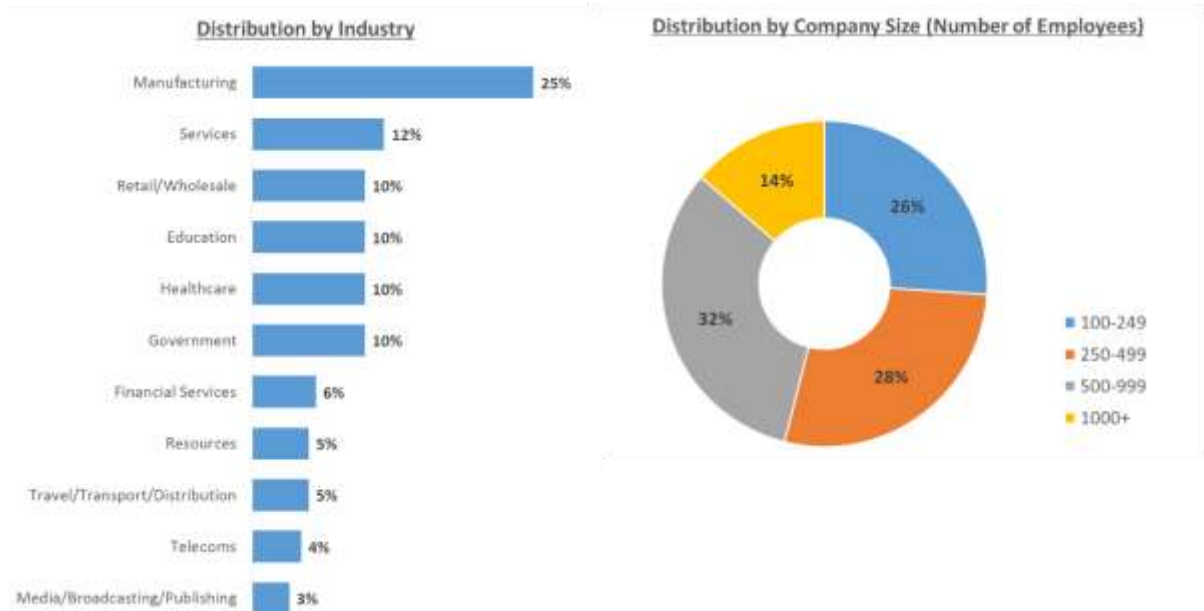
The countries analyzed include: Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Mexico, Peru and Venezuela.

IDC leveraged the results of an end-user survey conducted from February to May 2016 to define current and future trends related to the use and development of networking skills, as well as the role of the network in Latin American organizations. IDC contacted approximately 5,615 IT managers in order to arrive at 760 completed and valid interviews. At 95% confidence level, the margin of error for 760 interviews is +/- 3.55%.

Respondents represent organizations of 100+ employees and verticals including the following: Government; Healthcare; Education; Telecoms; Financial Services, Manufacturing; Retail & Wholesale; Media, Broadcasting & Publishing; Travel, Transport & Distribution; Resources and Services (c.f. Figure 1).

FIGURE 1

Distribution of respondents by Industry and by Company Size

Distribution by Industry

Industry	Percentage
Manufacturing	25%
Services	12%
Retail/Wholesale	10%
Education	10%
Healthcare	10%
Government	10%
Financial Services	6%
Resources	5%
Travel/Transport/Distribution	5%
Telecoms	4%
Media/Broadcasting/Publishing	3%

Distribution by Company Size (Number of Employees)

- 100-249: 26%
- 250-499: 28%
- 500-999: 32%
- 1000+: 14%

Source: IDC, 2016

The data from the survey has been used both to populate the IDC skills model and to make market predictions. It also provides with valuable insight from the IT buyer side in some very important areas, such as the maturity of organizations in new technologies, as well as policies in hiring networking professionals.

The model is based on economic and statistical indicators in each country, including gross domestic product (GDP), IT workforce estimates, population growth, and registered companies. It is also sustained by forecasts from IDC's syndicated studies, such as Latin America Enterprise Networks Systems Tracker, Latin America IT Services Tracker, Latin America Unified Communications Tracker, Latin America Software Tracker, Latin America Business ICT Services Tracker, Latin America Cloud Computing Technologies, Latin America Server Virtualization Tracker, Latin America Emerging Markets Tracker, Latin America Mobile Devices Tracker, Latin America Security Appliances Tracker, Latin America PC Tracker, and Worldwide Black Book. Please refer to the Appendix for a more detailed methodology description and glossary

SITUATION OVERVIEW

REGIONAL ANALYSIS

The ICT industry has been transitioning in the last 4 years to the third platform, a new technology platform that fosters growth and innovation, and that is built on the pillars of mobility, big data analytics, cloud services and social technologies. Concurrently, the decision centers for technology investments in the enterprise is shifting from the

CIO into the Lines of Business, creating pressures for flexibility and optimization of the infrastructure to adapt to an ever changing business environment. Furthermore, technology innovation is now at the center of the agenda of executives and decision makers, with Digital Transformation as the underlying narrative that aims at anticipating and managing disruption and process transformation for business advantage.

Latin America is not immune to these trends. IDC predicts that the third platform will be the initial IT infrastructure point in Digital Transformation, and that it will involve 40% of IT infrastructure investments in the region. The region, however, is still at the beginning of this transformation process in ICT, with 70% of companies in the early stages in the journey to Digital Transformation; and with traditional technologies still conforming a large portion of the ICT spending.

After years of growth, 2015 signals a clear downturn in the Latin America economy, fueled by a sharp decrease in price of commodities, extreme in the case of oil prices, which has impacted greatly the economic environment in Latin America. Currencies have dropped, unemployment has begun to rise in some countries, and inflation is looming. As a result, the ICT market, once growing at a faster rate than the rest of the world, is now decelerating. As commodity prices begin to slowly increase, currencies stabilize and political transformations in some countries are working to curtail corruption, IDC projects a more sustained growth in the medium term.

Still, population dynamics are not unfavorable. Levels of poverty have dropped to 28% (*2014. Source: ECLAC)* and have remained at that level since. IT spending per capita is at $225 in 2015, still significantly lower than $460, the worldwide average, but in Chile, it is $410, only slightly below. However, telecommunications spending in the region was at $340 per capita in 2015, above the worldwide average of $320. In Brazil, for example, telecommunications spending was $470 per capita, 47% above the worldwide average. Since 2007, Latin America has outgrown the worldwide ICT market by a factor of 3.9, and even with an economic recovery period ahead and under currently unfavorable economic conditions, IDC expects this to continue, albeit at a much lower factor of 1.2.

The networking market is at the sustaining base of the technology infrastructure, and as such it is subject to the dynamics that result from the economic environment affecting the region, and by the new technologies and business models that are reshaping the investments in IT infrastructure. New developments in technology pursue an ever increasing productivity and automation, to lower the labor costs associated with the operation of networks. Also, cloud computing, is expected to grow, and as a result, important economies of scale will also affect the need of skilled professionals in operation and maintenance of networks. It is expected that, by 2020, half of investments in IT infrastructure in Latin America will be cloud related. In addition, the free fall of currencies experienced in 2015 and early 2016, as well as restrictions in imports or dollar availability in some countries in the region, have affected the levels of capital expenditures in ICT and shifted the expense to maintenance of the current infrastructure and services, including outsourcing, that are paid in local currency.

These facts indicate how Latin America is advancing in the journey for transformation through technology adoption and innovation, increasing its competitiveness in the world and solving its unique challenges. This journey, however, is not easy. Adapting to a rapidly changing technology landscape is key for success. Some technology trends in the region are worth mentioning. Among them:

◻ Cloud computing, a key pillar of the 3rd Platform

Cloud computing is a powerful market driver that will shape IT spending over the next several decades and is impacting the network in terms of capacity, agility and management. IDC estimates that cloud services spending will continue to grow at double-digit rates for the next few years, gradually accounting for a larger proportion of all IT spending. Intensive investments and migrations towards the cloud, have impacted in cloud-ready deployment networks in the Data Center to implement hybrid environments. In the short term and medium term, cloud will have a negative impact on IT spending, enabling end users to lower their overall spending on certain solutions and demanding cloud skills.

The key operational advantage to cloud services is the ability of IT organizations to shift IT resources from maintenance to new initiatives, taking advantage of cloud's inherent agility and elasticity. This will result in challenges on the kind of IT resources more involved in strategic business initiatives in their organizations.

◻ Open source and network disaggregation: impacts on the rise of DevOps

Software-based value and business models have demonstrated their effectiveness in responding to new customer demands that enable new buying experiences and that definitely will impact network disaggregation and open source networking solutions deployments. As the network is evolving to a more dynamic approach of openness and separation between hardware and software capabilities, the ascent of DevOps will result in the restructuring of enterprise IT departments, with changes to roles and responsibilities, including those relating to procurement, deployment, and management of products and technologies. The role of professionals involved in networks with responsibilities in middleware integration is lagging behind developers that are gaining primacy and influence over decision relating to the infrastructure that underlines and deliver their applications.

◻ Software Defined Networks behind transformation

Software-defined networking arose as a new approach to network architecture occasioned by virtualization and cloud computing. Although deployments are still in the early stages, companies are preparing the road in which SDN will enable automated provisioning, network programmability, service chaining, and integration with cloud orchestration systems. SDN has arisen as an answer to many challenges posed by virtualization and cloud and as a response to the limitations posed by traditional networking architectures and operational practices. The impact of SDN will require new skills in the traditional architectural and operational networks including the datacenter networking solutions during the next years. The implications for companies and its network professionals will imply capabilities to rapidly align to network refreshes to business outcomes.

◌   Prevalence of the importance of network security

Security experts are warning about the security and privacy risks posed by the explosion of Internet-enabled devices that collect and transmit data. As networks is the point of entrance of different devices connected (considering IoT implications), efforts to strengthen its security at this initial point of vulnerability will remain. Increasing external threats on companies affecting both reputation and operational integrity, are driving strategic investments in Cyber security. As security markets are continuously evolving to stop threats, the challenge for organizations to attract and retain IT security talent could have an impact on overall spending on additional network security products or refreshes to existing security infrastructure.

◌   Convergence and integration of UC&C to business and Mobility

The market of UC&C is gaining complexity and as companies are increasing the use of more collaborative tools and applications, especially with respect to mobility and videoconferencing. Business customers are increasingly looking for options that support an easier user experience with "anywhere, anytime" access to content while also being interoperable with an array of other consumer-centric applications. To create platform stickiness, vendors offer APIs to the ISV community, creating ecosystems around their UC&C platforms. Companies are now challenged to keep the life-cycle of their legacy deployments an overcome the complexity of managing the solutions. If cost savings helped drive IP telephony deployments in the early stages of market adoption, aspects like better end-user experiences, cloud, mobility, video, and integrations with communications and collaborative applications, will be key factors for businesses and professional to migrate to new UC&C solutions.

◌   The ascent of mid-size companies in the adoption of technologies in Latin America

Mid-size companies and start-ups are gaining relevance in the region especially in markets such as network security and unified communications. Double-digit growth rates in markets like cloud, are considerably more relevant as many businesses are considering the advantages of leveraging a monthly subscription model for their next deployment. Transitioning to the cloud is helping organizations to scale up quickly, reduce capital costs, improve application performance, and better allocate their resources, among other benefits.

Total Networking Skills Demand and Supply Trends in Latin America

Region-wide, IDC estimates that the demand for networking skills in Latin America currently outstrips supply and will continue to do so during the forecast period (c.f. Figure 2). Total Networking Skills is the aggregation of essential and emerging networking skills. For 2015, IDC estimated a shortage of approximately 474,400 FTEs in professionals with networking skills across the Latin America region, with this number only slightly increasing to 449,152 FTEs by 2019. These figures represent a skills gap (calculated as a proportion of total demand) of 38% in 2015 which effectively decreases to 32% in 2019. The number of skilled people is based on IDC's proprietary skills model which calculates full time equivalents (FTEs) which are defined as IT professionals spending 100% of the time working with networking technology.

Total Networking Skills Demand and Supply Trends in Latin
America, 2015-2019
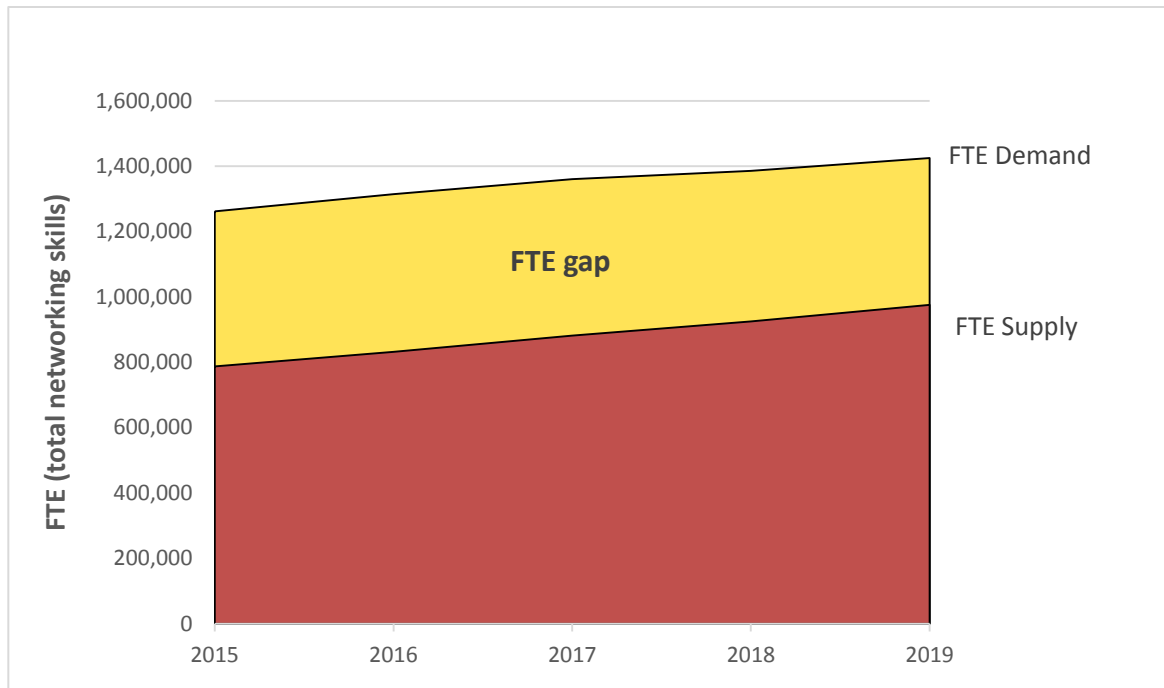
Source: IDC, 2016

Essential and Emerging Networking Skills Gaps in Latin America

In just a few short decades, information technology has moved from the back office (IDC's 1st Platform) to the front office (the 2nd Platform) and, finally, embedded itself into nearly every aspect of people's business and personal lives, fueled by 3rd Platform technologies, including mobile, social business, cloud, and big data and analytics (BDA). In that evolution, the distinction between the technologies and processes that businesses deploy have become so tightly linked to their customers and markets that the boundary between the internal operations of the enterprise and its external ecosystem (e.g., customers, markets, competitors, partners, regulators) is rapidly disappearing. Businesses that wish to thrive in the digital era need to make substantive changes in order to move from deploying technology to achieve process efficiencies to the next level, that of digital business transformation, employing digital technologies coupled with organizational, operational, and business model innovation to create new ways of operating and growing businesses. Those enterprises that have achieved digital maturity have embraced digital transformation as a new and better way of life.

Under the premise of digital transformation, networking teams cannot be conceived in the same way as previous years. Jobs and skills need to evolve to understand the impact that the network has on business models, otherwise, existing teams working

on essential technologies will fall behind and be overcome by those who can combine business and technological aspects.

According to the results of the current study, in 2015 the gap amounted to 474.379 FTEs in Latin America, with 55% of this gap in emerging technologies. Much of this gap focuses on Data Center, Virtualization and SW Development skills. For 2015, the demand for professionals for those technologies was 61% of the total demand of networking skills required to meet the needs of businesses. By 2019, it is projected to be 57% of the total skills needed.

The need for more professionals in those technologies responds to the necessity of challenges that the networking infrastructure will confront in the years ahead that will require more people skilled in new technology. While the 3rd Platform, and especially cloud computing, is driving much of that change, other factors are at work too.

The value migration from networking hardware to networking software is certainly a key market transition, forcing vendors to consider changes to their product portfolios and business models that in some cases (especially in the Enterprise segment) could benefit by a decrease in the gap in essential technologies, but can also create an oversupply if those professionals are not prepared to improve their emerging capabilities. Over this transition, the challenge is to have the professionals prepared to manage a network with software capabilities. These challenges are made more acute by the rise of converged infrastructure, software-defined infrastructure (SDI), software-defined networking (SDN), and network disaggregation, which involve the decoupling of device-level network hardware from the network operating systems that runs on them.

Companies are looking beyond traditional network architectures and operational models in search of infrastructure solutions that support increased virtualization, cloud, burgeoning mobile traffic, and the business imperatives of agility and service velocity, demands that can be reflected in product capabilities such as automated provisioning, network programmability, support for popular cloud orchestration systems and public clouds, integration with network virtualization overlays, and adoption of industry-standard southbound and northbound APIs (as they develop).

As a result of this trend, essential technologies show signs of decline by 2019. According to the Networking Skills Gap Model, in 2019 only 38% of the total gap will be concentrated in these technologies, mainly driven by security skills that will represent 46% of the gap. Network Security teams will continue leading the execution of strategies in the cybersecurity team as part of the treatment and monitoring that networks must have in order to deploy more technologies. Only in this case, network security teams will continue having a core participation in the deployment of other technologies in the company such as IoT.

Clearly companies have shown an interest in moving its staff into other areas of technological expertise and to involve other lines of business development and technological decisions, which represent a challenge to the existing structures of areas networks in enterprises.

Essential and Emerging Networking FTE (%) Skills Gap in Latin America, 2015-2019
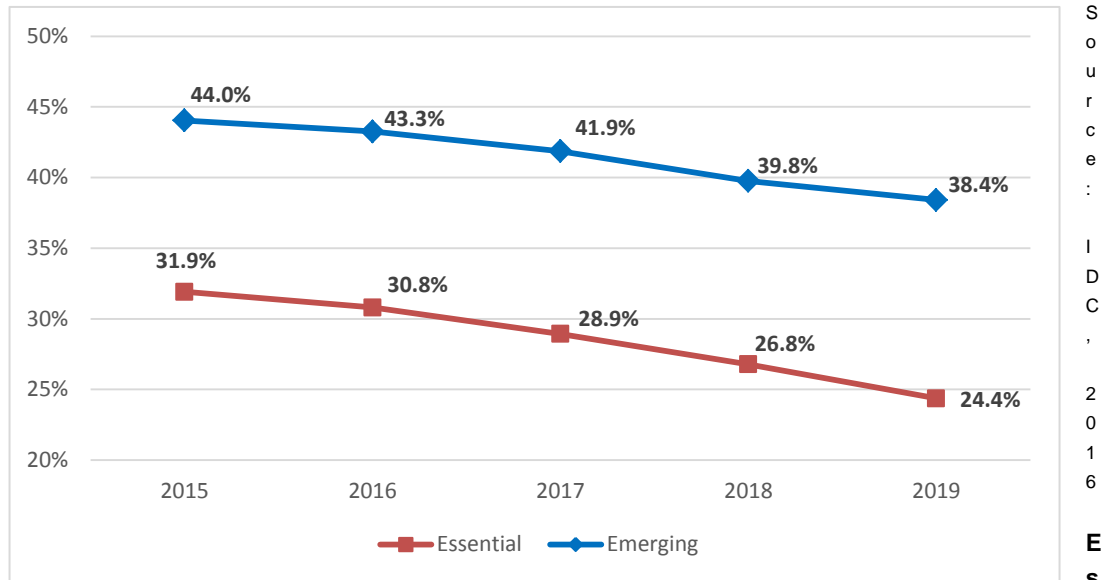
sential technologies. Total demand of FTEs for these technologies will grow at a CAGR of 1.0% 2015-2019. The third platform is sustained on a robust automated network that requires skilled professionals in the essential technologies that conform it. Networking, however, is experiencing a critical transformation, still on its early stages, but with significant impact in the way that networks have been traditionally implemented. Hardware disaggregation from software capabilities and open environments promise more efficient options to operate networks in a more automatized and self-provisioned manner. This change means good news for companies to automate their process but challenges in aligning its internal skill capabilities of even keep them in the organization. Security would continue playing a critical role in the network since, as more elements are connected to the network, risks and threats to information increase. Wireless technologies are healthy and clearly benefiting from the explosion of mobile devices but also are being impacted of rapid renovation cycles that demand a seamless integration between fixed and mobile infrastructure (unified access) and more specialization in solutions that help enable business though the implementation of analytics over the wireless network. Finally, businesses are increasingly adopting mobile applications to communicate with their employees, enhance business processes, and streamline customer interactions, as well as UC providing the "glue" that unifies customers' UC road map with their business strategies and processes.

Emerging technologies Total demand of FTEs for these technologies will grow at a CAGR of 5.3% 2015-2019. Changes impacting companies to deliver more centric experience products and services to their clients have their have as the center of the strategy a strong demand for greater efficiencies within the datacenter IT infrastructure coupled with increasing pressure to shorten the cycle of delivering new applications to the business. Emerging technologies are evolving to a more converged IT infrastructure that is shaping networks in the data center looking for

more efficiencies, automated and auto-provisioning networks that can move as the same pace of technologies such as cloud or big data that definitely are challenging current capabilities and favor new software network architectures. With the explosion of more devices and applications considering in the mobility field, and sensors in IoT projects taking place in the region, capabilities in networking professionals would have to evolve skills never experienced before. Software specialization in the development of applications that support the business would be one of the most relevant aspects that professional would have to consider. Robust groups of experts covering security aspect that go beyond the network are being evaluated for more companies as they are understanding that prevention and predictability (big data solutions) are in the center of business proposition and prevention of possible threat as other benefits.

Non-technical skills

In the 2012 study, IDC highlighted the need for the network professionals to have multiple technology skills, in addition to those skills more commonly associated with technology roles with the required specialization. In addition to cross-technology skills, this study includes other non-technical areas, such as: proficiency in the English language, project management, understanding impact of the network and technology in the business, problem solving, creativity and innovation, team work, communication skills, industry knowledge, and "entrepreneur" attitude.

All respondents indicated the importance of at least one of these areas. IT executives in Latin America give special importance to "softer" skills such as proficiency in English, team work, creativity and innovation, problem solving and communication skills; sometimes over other skills more commonly associated with the technical activity, like project management and industry knowledge.

This is an indication of the need for the network professional to combine multiple skills, technical and non-technical in order to support an increasingly complex business environment. The challenge of finding qualified staff with non-technical skills is compounded by the fact that networking professionals are also expected, not only to demonstrate cross-disciplinary skills that extend beyond IT into financial and project management to justify new technology ROI and manage operations. It is also expected that those professionals have also developed those skills that are necessary to foster innovation in the organization and to manage themselves effectively within the company as a whole and with the complex ecosystem of suppliers, customers and business partners.

Assessment of Networking Skills

The need for networking professionals continues to grow in Latin America. As the analysis of the region indicates, the skills development has not been growing at the same rate of demand. However, this trend is slightly decreasing, as the region evolves to a more mature stage, as compared with the 2012 study. In particular, in general networking technologies, the supply of professional surpasses the demand, and this trend is expected to continue, as outsourcing of network administration and operational efficiencies have been well adopted by companies in the region. As companies in the region mature in terms of technology adoption, network

organizations in the region are evolving towards a more specialized role. Under these circumstances, the challenge lies in implementing at the company level, effective paths for specialization of network professionals. It is important to note also, that educational institutions should adapt their programs in order to evolve their curricula, and governments should consider these in defining their programs for technology development.

IDC's survey within 10 countries of the region found the following:

☑ Averaging all technology areas, 55% of respondents stated that they plan to hire networking professionals or maintain their current staff in the next 12 months.

☑ A very significant portion of the organizations (62%) across the 10 countries surveyed found it difficult to find networking engineers who have the right skill set to meet their organizational requirements. The primary reason they find is the difficulty in finding professionals with the right combination of skills, including proficiency in the English language, and the cost associated with hiring. The second reason is the difficulty in assessing the quality of the applicants.

☑ For essential technologies, network security skills positions continue to be the most demanded and difficult to fill, with 64% of companies increasing their staff in the last 12 months. When compared with the 2012 study (87%), this represents an improvement in the availability of these skills. For emerging skills, SW development represents the area where more hiring is expected. 68% of companies surveyed have hired people with SW development skills in the last 12 months.

☑ The majority of companies (60%) are willing to hire professionals with 2 years' experience or less, and complement with training programs to reach the required level of skills proficiency, compared with 33% that only hire fully trained professionals. This indicates the difficulty and cost in having a very skilled labor force, when compared with the availability and cost of professionals with less experience. The respondents also indicated that internship programs and online job boards are the preferred methods to identify and recruit those professionals. This highlights the importance of training programs for vendors and educational organizations, as well as on-the-job training.

☑ Retaining network professionals is also an issue to be considered. 53% of companies find difficult to retain network professionals in their organizations. Having a better salary offers is the most important primary cause for a network professional to leave the company, and the lack of a clear path to professional advancement, as well as issues with management and coworkers are the most cited secondary causes.

☑ Network certifications continue to play a very important role in developing the skills of organizations so they adapt, innovate and grow in their use of technology. 52% of companies have sent their staff to vendor certifications programs and courses.

☑ The shortage of skilled professionals, especially in the small and medium companies, and the costs in acquiring, operating and maintaining the network

infrastructure make outsourcing a viable option for companies in Latin America. IDC's survey indicates that, on average, 26% of respondents outsource either partially or totally, the operation of their networks. This varies greatly with company size. For companies within 100 and 250 employees, 32% outsource their networks, whereas for companies with more than 1,000 employees, only 19% do so.

FUTURE OUTLOOK

The Changing Role of IT

IT systems continue being increasingly perceived as a business differentiator and facilitator within Latin America enterprises, as the region continues its path to maturity. Large and medium organizations all across the region rely on a strong and flexible corporate infrastructure, in which the network plays a fundamental role. More specifically:

- ☑ Of all respondents interviewed, 37% say that the network is a key platform for process sharing with key partners, suppliers and customers.

- ☑ IT managers in 35% of all companies interviewed use the network as a means to remotely access enterprise systems.

- ☑ 25% of the firms use their network as a collaborative platform in which employees interact using specific applications.

In addition to this, emerging technologies such as video, datacenter & virtualization, cloud and mobility are increasingly an integral part of the enterprise network infrastructure, increasing the importance of the role played by the IT platform within organizations of all sizes. IoT (Internet of Things) projects are beginning to appear in certain industries and countries in Latin America, and will increase the need for a robust and flexible network infrastructure.

The network sits at the core of the IT infrastructure that supports innovation and business optimization in organizations of all sizes, public and private. This is confirmed by IDC's related market forecast for the Latin American region. According to IDC's Enterprise Network Systems Tracker:

- ☑ Network Security equipment revenue will increase at a rate of 5%, reaching $560 MUSD in 2019

- ☑ Wireless LAN equipment revenue will increase at a 2015-2019 CAGR of 7%, reaching $292 MUSD in 2019

- ☑ Emerging technologies including Video, Cloud Computing, Mobility and Datacenter & Virtualization will increase together at 23% CAGR in market value in 2019. Technologies such as Cloud Computing show the highest CAGR of 28% thru 2019. Followed by other technologies such as Datacenter and Virtualization that will grow at a CAGR of 21% and 14% respectively. Finally, solutions such as Video and Mobility will increase their value at average percentages of 8% and

9% and -3% respectively.   Investment in general switching and routing equipment is expected to have a 2011-2015 CAGR of 8%, reaching approximately 25.9 million units in 2015.

Emerging technologies are now considered as a very important part of the total network infrastructure of companies, and IDC expects this trend to continue as the third platform of computing consolidates as the foundation for digital transformation. According to IDC's survey, an average of 27% of the companies' networking budget is dedicated to acquire and support those technologies, with only small variations related to geography, from a minimum of 26% for Venezuela, to a maximum of 29% for Chile.

Network organizations are also actively participating in technology initiatives in companies in IoT, Cloud, and Big Data. However, the survey indicates that, as those projects are frequently funded and managed within the LOB (Line of Business), this participation is relatively low, limited, on average to 1-2 FTEs. Also, the involvement of the network organizations in these initiatives is, on average, 60%-70% related to operational activities, such as network management, maintenance and support of the underlying infrastructure. This suggests that IoT, Cloud and Big Data projects are supported by partial dedication and project assignment of existing staff in the network organization, and this trend can change in the near future as these technologies continue their way into the core of the IT infrastructure.

IDC projects that, in Latin America, in the 2015-2020 period, the Internet of Things (IoT) will grow with a compound annual growth rate (CAGR) of 16.9%, with focus in some countries and industries, where use cases for IoT results in clear business outcomes. On average, only 17% of the respondents of the survey indicated that they were currently involved or expected to start an IoT project in 2016, mainly in Brazil, Mexico and Argentina, and in companies in Telecommunications, Natural Resources, and Manufacturing.

Total Networking Skills Shortage

For the purpose of providing further insight into the existing and future requirements for networking professionals across the region, the IDC skills model was used to quantify demand, supply and the subsequent gap. In this report, the definition of networking skills includes all people needed to plan, design, manage, and maintain networking technologies and infrastructures within an organization.

IDC also used the concept of FTEs to allow direct comparison between countries, industry sectors, and other factors. By definition, FTEs are staff members that spend 100% of their time on networking-related activities. Because research has shown that, on average, networking professionals spend 60% of their time working on networking tasks in the Latin America region, the IDC model also uses the concept of skilled people that includes all people with formal training and certifications in essential and emerging technologies to plan, design, manage and maintain networking technologies and infrastructures within organizations.

As shown in table 1, IDC estimated that demand for networking skills in organizations will reach close to 1,262,000 FTEs across Latin America in 2015. This number represents the total amount of work that needs to be done in the networking space,

and the number of people that need to be assigned to these tasks – assuming that they all spend 100% of their available time on networking.

The total of professionals estimated for Latin America includes those for essential and emerging technologies. Considering these technologies, the undersupply of 474,379 FTEs in 2015 represented a shortage of skilled people of around 38% of FTEs in 2015, slightly decreasing to 449,152 FTEs by 2019. IDC estimates that the total networking skills gap in Latin America, expressed as percent of FTE demand, will slightly decrease by 1.4 percentage points in the 2015-2019 period, slightly decreasing from 38% in 2015 to 32% in 2019.

T A B L E 1

Total Networking Skills in Latin America (2015-2019): FTEs and Skilled People Estimates

	2015	2016	2017	2018	2019	CAGR 15-19
FTE Demand	1,261,966	1,314,558	1,360,527	1,385,862	1,425,082	3.1%
FTE Supply	787,587	832,130	881,885	925,279	975,930	5.5%
FTE Gap	474,379	482,429	478,642	460,583	449,152	-1.4%
% FTE Gap	38%	37%	35%	33%	32%	
Skilled people Gap	664,100	675,400	670,100	644,800	628,800	-1.4%

Source: IDC, 2016

Another way to look at the gaps in networking skills is to examine how the sizes of the forecast percentage gaps for each country compare with one another. Such an examination provides an interesting ranking of countries (table 2). While the position of each country in the table is indicative of the situation faced when it comes to skills shortfalls as a proportion of total demand in each country, it is also important to examine how the magnitude of the gaps (skilled people estimates) relate to the relative size of the technology markets that exists in each of these countries. This provides a clear picture of the challenges ahead.

T A B L E 2

Total Networking Skills Gap Index by Country

	2015		2019	
	FTE Gap	Gap %	FTE Gap	Gap %
Argentina	13,580	**33%**	12,771	**30%**
Brazil	195,365	**41%**	161,581	**36%**
Chile	19,513	**31%**	5,302	**9%**
Colombia	28,350	**30%**	25,195	**22%**
Costa Rica	4,898	**30%**	3,566	**18%**
Dominican Republic	6,090	**41%**	6,639	**37%**
Ecuador	8,669	**35%**	9,201	**31%**
Mexico	157,934	**40%**	148,052	**33%**
Peru	15,531	**38%**	17,148	**31%**
Venezuela	7,826	**33%**	23,167	**56%**
Rest of Latin America	16,624	**23%**	36,529	**26%**

Source:

IDC, 2016

Brazil has the largest overall networking skills gap both in absolute and in percentage terms. Brazil is currently going through a political and economic crisis the country hasn't seen in decades, but the momentum of technology expenses both enterprise and consumer, still drives a demand that is still not fulfilled by the availability of networking professionals, even under increasing unemployment. Despite government policies the gap remains high. This trend, however, is expected to correct slightly, due to continuing efforts of government and industry in the development of ICT professionals, and a corrected, more stable cost structure for labor.

Colombia and Costa Rica have the lowest percent gap of the countries considered for this study. In Costa Rica, an increasingly business-friendly environment, and the development of a service economy leveraged in technology, is driving interest in technology in university entrants, coupled with a clear government strategy to develop the sector. Colombia has a clear strategy centered on establishing in the country the necessary educational infrastructure and innovation platform, which has bear fruit. Colombia, Costa Rica, and, more specifically Chile, are poised to have relatively low skills gaps in 2019. In Chile, both the efforts of the government and a more stable growth expected in the period, will result in a drop of 22 percentage points in 2019, compared to 2015.

On the other hand, Venezuela is the only country of the ones analyzed in this study, with an increase in the skills gap, in terms of percentage. The country is currently experiencing a profound economic crisis, which makes the demand for networking professionals very low for a country of its size. In the event of an eventual economic recovery the demand of skilled professionals should grow, but with continuous "brain drain" and less emphasis in technology training, the gap is expected to grow rapidly. It is expected that in 2019, Venezuela will have the largest gap in percentage terms.

In Mexico, the skills gap remains high at 40%. The country has seen a more stable and sustained growth in recent years, but the pace of formation of network professionals still lags behind the technology development of the country. As the country matures in terms of technology adoption, and the government and industry programs, a large source of investment, bear fruit, IDC expects this gap to lower to 33% by 2019.

Argentina, until recently, was under with a similar, but not as profound, economic crisis similar to Venezuela. Taking into consideration the policies of the new administration, and a renewed interest in technology in enrolled students, IDC expects that the skills gap will slightly decrease, from 33% in 2015 to 30% in 2019.

In Peru, after strong investments due to high levels of economic development, that is driving an increase in technology education enrollment, the skills gap is expected to decrease in percent terms, from 38% in 2015 to 31% in 2019.

Demand for Essential Technologies Skills

The survey conducted by IDC in 10 Latin American countries showed strong intention for essential technology skills hiring across all countries, industry sectors, and sizes of organizations analyzed.

According to the IDC economic model, IDC estimates that the demand for essential networking skills will climb from 670,900 FTEs by the end of 2015 and will reach almost 699,400 FTEs by 2019. This represented a percentage gap of 32% in 2015 and will be 24% in 2019.

TABLE 3

Total Essential Networking Skills in Latin America (2015-2019): FTEs and Skilled People Estimates

	2015	2016	2017	2018	2019
FTE Demand	670,909	692,563	703,712	696,750	699,394
FTE Supply	456,846	479,228	500,080	510,136	528,973
FTE Gap	214,063	213,335	203,632	186,614	170,420
% FTE Gap	32%	31%	29%	27%	24%

Source: IDC, 2016

Looking at the specific essential skills in demand, security, tops the list with 49% of FTE gap in 2015, which remains at that level in 2019, a trend that is expected to continue, given the current focus in cybersecurity that drives also the need for network security skills.

Following security, wireless is also an area of focus in essential skills needed to run the network infrastructure. As more and more devices are connected to the network and mobility applications thrive, this skill is becoming critical. Companies understand this and it is expected that the gap will slightly drop from 46% in 2015 to 44% in 2019.

General networking technologies, such as router and switch, are rapidly losing relevance in the set of skills needed in the network professionals, going from a gap of mere 8% to an effective surplus of close to 7,500 professionals in the region.

The gap in essential technologies varies from country to country, according to table 4. The vast majority of countries in the region show a decrease in the gap in these skills in the 2015-2019 period, with some notable cases, like Chile, Costa Rica and Peru, where the large drops put these countries in a good position for a shift to more specialized skills. In Venezuela, the gap in essential technologies actually grows from

23% in 2015 to 29% in 2019, mainly due to skilled professionals leaving the country to look for better opportunities elsewhere.

T A B L E 4

Total Essential Networking Skills Gap Index by Country

	2015		2019	
	FTE Gap	Gap %	FTE Gap	Gap %
Argentina	5,882	27%	2,257	10%
Brazil	82,607	34%	65,665	30%
Chile	4,811	18%	1,110	5%
Colombia	11,998	24%	8,627	16%
Costa Rica	2,421	24%	935	8%
Dominican Republic	3,122	38%	2,318	25%
Ecuador	4,952	39%	3,476	25%
Mexico	79,736	37%	75,316	34%
Peru	7,497	30%	956	4%
Venezuela	1,883	23%	3,305	29%
Rest of Latin America	9,154	18%	6,455	7%

Source: IDC, 2016

Demand for Emerging Technologies Skills

The continuous evolution of technology imposes important challenges to organizations and countries to leverage innovation for progress and profit. As a very important part of this study, IDC has conducted research on skills gaps of emerging technologies including: Video Technologies, Cloud Computing, Mobility, Datacenter & Virtualization, Big Data, IoT technologies, and Cybersecurity, as well as in SW Development, an increasingly important aspect of the activities of the network professionals. It is not surprising to note that these technologies represent the most substantial skills gap in the region, with 55% of the total of the skills gap in 2015, increasing to 62% in 2019.

According to IDC's model, the demand for emerging networking skills climbed to about 260,300 FTEs by the end of 2015 and will reach almost 279,000 FTEs by 2019.

T A B L E 5

Total Emerging Networking Skills in Latin America (2015-2019): FTE and Skilled People Estimate

	2015	2016	2017	2018	2019
FTE Demand	591,057	621,995	656,815	689,112	725,689
FTE Supply	330,741	352,901	381,805	415,143	446,957
FTE Gap	260,316	269,094	275,010	273,969	278,732
% FTE Gap	44%	43%	42%	40%	38%

Source: IDC, 2016

Datacenter & virtualization skills remain the most challenging area in terms of finding skilled professionals. Server virtualization and datacenter are vital in the development of IT environments and the majority of medium and large organizations in the region are involved in the transformation of their datacenter in one way or another. The gap

in this field is the largest proportional gap in all new technologies. For 2015 the FTE Gap in Datacenter & Virtualization is 124,740 FTEs, which represent 48% of the total FTE Gap for emerging skills, with similar projections for 2019, with an FTE Gap of 136,277 FTEs, representing 49% of the FTE Gap for all emerging technologies.

Trends such as virtualization, driven by the steady preparation for cloud ready environments and the availability of all types of mobile devices continuously connected to the network, are creating a series of challenges for IT departments. These IT departments must figure out how to deal with the increasing complexity of corporate network infrastructure and how to ensure its reliability and safety while controlling the rising costs.

It should be noted that in IoT and Big Data, the Line of Business (LOB) is very involved in many aspects related to the purchase and implementation of projects on those technologies, and that the involvement of the IT departments is, sometimes, at best, as a participant in the purchasing process, and in sustaining the associated projects on the network infrastructure. The companies interviewed indicated a relatively low participation of networking staff in IoT and Big Data, on average, about 1-2 people, which suggests that those technologies are supported via partial dedication of existing staff. As a consequence, the IDC model indicates substantially lower absolute FTE gaps for IoT and Big Data, whereas the % of FTE demand is comparable to other emerging technologies.

Security teams continue to be key in network organizations. With the evolution of technology into the 3rd platform, these specialists require a more comprehensive skills set, to include knowledge of technologies like software and cloud, as well as a thorough understanding of the impact of security in reputation of the company and operational integrity. The IDC model includes a more gradual evolution into cybersecurity in the 2015-2019 period, causing a small FTE gap in comparison to network security. This was reflected also in the answers provided by the companies interviewed. Although 86% declared to have a cybersecurity strategy, only 42% indicated the inclusion of vulnerability management, which is an element in more proactive strategies. Most companies are still focusing their strategies in end point and network security.

The gaps for all emerging technologies is shown below in table 6:

TABLE 6

Emerging Networking Skills Gap Index by Technology

	2015		2019	
	FTE Gap	**Gap %**	**FTE Gap**	**Gap %**
Video Technologies	20,604	**62%**	22,953	**61%**
Cloud	40,105	**47%**	25,946	**21%**
Mobility	29,321	**46%**	46,955	**62%**
Data Center & Virtualization	124,740	**46%**	136,277	**53%**
Big Data	9,638	**52%**	7,053	**24%**
Cybersecurtiy	4,128	**35%**	3,338	**22%**
IoT	4,465	**34%**	3,860	**20%**
SW Development	27,316	**29%**	32,350	**31%**

Source: IDC, 2016

TABLE 7

Emerging Networking Skills Gap Index by Country

	2015		2019	
	FTE Gap	**Gap %**	**FTE Gap**	**Gap %**
Argentina	7,698	**42%**	10,514	**49%**
Brazil	112,758	**49%**	95,916	**41%**
Chile	14,702	**42%**	4,192	**11%**
Colombia	16,352	**38%**	16,568	**28%**
Costa Rica	2,477	**38%**	2,631	**30%**
Dominican Republic	2,968	**44%**	4,321	**51%**
Ecuador	3,718	**31%**	5,725	**36%**
Mexico	78,197	**42%**	72,736	**31%**
Peru	8,034	**52%**	16,192	**56%**
Venezuela	5,943	**38%**	19,862	**66%**
Rest of Latin America	7,470	**37%**	30,074	**62%**

Source: IDC, 2016

Country Analysis

Argentina

In recent years, Argentina has been characterized as a market with frequent alternation of periods of economic up and downturns. This situation has ultimately led to restrictions on imports in all segments, including technology. The ICT investment ratio to GDP has clearly decreased, from 2.3% in 2012 to 1.5% in 2015, signaling a sharp decline in market growth expectations.

Inflation in the country reached a high mark of 37% in 2015, significantly affecting the market and the demand for professionals. The high cost of certification for enterprises, and the risk of losing the investment in training staff that is highly demanded by the market, conforms an inhibiting factor that threatens the development of a technology infrastructure in the country. 32% of companies in Argentina mention that the main reason why they find it difficult to find professionals is

the cost of hiring, whereas for Latin America in average, 27% mention it as the main factor. The 'brain drain' has played an important role in widening the skills gap, since Argentina is a country with professionals with high technical capacity, and many professionals have left the country for better opportunities.

Argentina is the Latin America country with the highest proportion of network professionals per company, but with a more traditional approach to networking, with 87% of companies that see the network providing connectivity, the highest in Latin America.

IDC estimates that the IT market will decrease in the period 2015-2019, with a CAGR of -0.2%. According to the model, IDC estimates that, in 2015, there was a gap of 13,580 FTE, with this number slightly decreasing to 12,771 in 2019. These numbers represent a gap of 33% in 2015 and 30% in 2019. 82% of the gap in 2019 will be in emerging technologies.

Brazil

Because of the size of the Brazilian economy, the country will continue demanding network professionals, and will not be able to close the gap in the period of study. The high potential of the domestic market, drives the increasing demand of services in all segments, especially in mid-size companies. Many large data center services companies have set their operation in country, due to high tariffs for imported goods, and legal regulations on cloud for the physical permanence of information in Brazil. This has driven additional demand of professionals, which has widened the skills gap.

The cost of labor in Brazil, the highest in the Latin America region increases the difficulty for companies that have their own data centers to find the number of professionals they require. 75% of companies in Brazil find difficult to recruit the staff with the required skills combination, the highest in Latin America. This trend is the reason why companies are increasingly opting for outsourcing the management of their network.

The study shows a more mature understating of the network in the companies in Brazil. 45% of companies see the network as the platform that sustains business processes, a higher value than the Latin America average of 37%. Additionally, investment in Brazil in new, emerging technologies, is considerable. 38% of companies in Brazil will invest in IoT projects in the short term, higher than any other country in Latin America. All these factors contribute to higher difficulties of hiring network professionals with the right skills set.

Brazilian companies find very important that their network professionals understand how technologies impact and enable the business, so they value cross technology skills, entrepreneur attitude and strong knowledge of industry in their networking staff.

IDC estimates that the IT market in Brazil will grow in 2015-2019 at a rate of 3% CAGR. According to the model, Brazil will have, in 2015, a gap of 195,365 FTEs, decreasing to 161,581 in 2019. These numbers represent a gap of 41% in 2015 and 36% in 2019. 59% of the gap in 2019 is expected to occur in emerging technologies.

Colombia

Colombia has exceeded all investment expectations in ICT, stemming from the demand of technology in past years. Several government programs, such as Vive

Digital, that aims at closing the digital divide in small and medium business have resulted in a significant increase in the demand of new technologies. In Colombia, the network is used mainly as a collaborative platform for employees, partners, and customers, strongly relying on mobile devices to access applications in the network. Whereas in Latin America, in average, 25% of companies think of the network as the platform for collaboration, in Colombia, this number is 33%

Mobility and the use of applications in the network in Colombia will demand more staff with focus in security, with a greater vulnerability in the network caused by the connection of mobile devices, with skills in application development also growing. A large proportion of Colombian companies, 89%, show a strong interest in cyber security skills. In spite of a large demand of professionals, the country has been able to maintain an average skills gap in the region, since it has been relatively easy for companies to hire staff. In Colombia, 66% of companies have as a policy, hiring professionals with less than 2 years of experience followed by training. This is only second to Brazil, with 72%.

Colombian companies prefer entrepreneur attitude and innovation in problem solving as main skills in professionals. This profile helps companies grow and innovate.

IDC estimates that the IT market in Colombia will grow at the CAGR of 4.2% in the 2015-2019 period. According to the model used, Colombia had an FTE gap of 28,350 in 2015, slightly decreasing to a gap of 25,195 FTEs in 2019. This represents a gap of 30% in 2015 and 22% in 2019. 66% of the gap is in emerging technologies skills.

Chile

The Chilean economy has shown clear signs of stable growth, with a strong component of technology in key industries, like mining. The particular geography of Chile, with key cities and regions separated by large distances, promotes the use of the network mainly for remote connectivity. With a very productive labor force, Chile is the country with the smallest average number of network staff per company in Latin America, 10% compared with 12% as the average in the region. The country has also been successful in its fast adoption of technology, and companies show a high interest in the investment in emerging technologies. Therefore, the requirements are for professionals with technical skills developed in the areas of Data Center, virtualization, SW development and video, fueled by organic growth in these technologies.

Even under potential difficulties to find qualified staff, companies in Chile tend to employ only fully trained professionals, and value training and certification.

IDC estimates that the Chilean IT market will grow at a CAGR of 3.5% in the 2015-2019 period. IDC's model provides a gap of 19,513 FTEs in 2015, sharply decreasing to 5,302 in 2019. These numbers represent 31% in 2015 and 9% in 2019. Emerging technologies represent 79% of the gap.

Costa Rica

Costa Rica has maintained a sustainable economic growth. Long term estimates a growth of 4.6% in GDP in the period 2016-2019. The impact of currency and oil prices is expected to be small, which will help the growth of the domestic economy while promoting direct foreign investment that will help funding the demand of skilled professionals.

The degree of technology adoption in the country has facilitated the development of a labor force with a significant degree of technical qualification. Estimates on technology investment are positive, especially those emerging technologies where Costa Rica stands out in comparison with other countries in the region, investments that will drive a higher demand of professionals.

The increasing demand for professionals is compensated by a strong component of outsourcing of networking services. Costa Rica has the largest percent of companies (30%), of all Latin America companies that outsource their network operation. Productivity is also an important factor, In Costa Rica, companies have an average staff of 9 networking professionals per company.

In this high demand scenario, companies in Latin America are under constant threat of losing highly trained professionals to other companies. More than 93% of companies invest in network specific training to their staff, including certification with a large variety of companies.

There is an important area of opportunity in the development of English language skills in the country, as well as in the management of complex projects, and in soft skills such as innovation and understanding the impact of technology in the business

IDC estimates an IT market growth of 2.8% CAGR for the period 2015-2019. According to the model in this study, IDC estimates a gap of close to 4,900FTEs in 2015, decreasing to 3,566 FTEs in 2019. These numbers represent a gap of 30% in 2015 and 18% in 2019. Out of the total of this gap, 74% is due to emerging technology skills.

Dominican Republic

Small and medium companies in the Dominican Republic have seen a period of important growth as a result of the economic policies and government programs of the current administration, which has resulted in a strong growth of 7% in GDP. The recent drop in oil and other commodities has not affected greatly the country, which has compensated the lack of exports by a renewed and increased activity in the tourism industry, maintaining at bay currency fluctuations.

Economic stability and positive outlook, are promoting an uptake in foreign investment. Altice (Holland), RDC Resorts (Mexico) and Nestle (Switzerland), are some of the companies that are investing in significant operations in the Dominican Republic. This is increasing the demand of more network capacities and skilled staff in response to these additional requirements. This new demand is being met mostly by outsourcing to companies that provide the necessary flexibility and the economies of scale that are needed to support the increasing activity in small and medium businesses. The reliance of the economy in the tourism sector of the economy results in providing connectivity to hotels and other consumer businesses.

In terms of new technology adoption, companies in the Dominican Republic are focusing their efforts in cybersecurity. It is being increasingly difficult for companies in the country to find network professional in general, even more those that are proficient in skills in areas of high specialization, as cybersecurity. Therefore, companies are hiring staff with less than 2 years of experience, followed by a high

investment in training and certification. Second only to Cost Rica, with 93%, 88% of companies in the Dominican Republic regularly send their staff to technical training. Companies also value greatly problem solving skills as well as cross technology skills and innovation and creativity in their staff.

IDC estimates that the IT market will grow with a 2% CAGR in 2015-2017. The model indicates a gap of 6,090 FTEs in 2015, with a slight increase to 6,639 in 2019. This represents a 41% gap in 2015 and 37% in 2019, with 65% of the gap corresponding to emerging technologies.

Ecuador

Under the current administration, Ecuador has shown an important uptake in economic activity. However, the fall of oil prices has impacted the economy, which relies on oil exports as a very important addition to its economy, other than more traditional agribusiness exports. The current administrations end in 2017, introducing elements of uncertainty about economic policies that could affect the technology development of the country. The country has also expanded its commercial relations which China, which is also impacting the dynamics of the ICT market in Ecuador.

Companies in Ecuador are mostly in initial stages in the journey to a more important role of the technology infrastructure in their business, with 75% of companies running their own network infrastructure internally.

The network is evolving towards playing a more important role in the business, with an emphasis in investing in certain emerging technologies. The focus is on mobility technologies, driving a higher demand for professionals with skills in managing wireless networks.

Business growth in companies in Ecuador will be the main factor promoting demand of professionals, mainly to strengthen connectivity among companies and clients, and with their ecosystem. Under this scenario of generalized high demand for skills in Ecuador, finding people with the complete set of skills is increasingly difficult. As a consequence, companies pay special attention to retaining highly skilled professionals. With 52% of companies retaining their staff, Ecuador stands out in comparison with Latin America, where 47% of companies being successful in retaining their staff.

IDC estimates a decrease of -0.8% CAGR of the ICT market in the period 2015-2019. According to the model, IDC estimated in 2015 a gap of 8,669 FTEs, with this number increasing to 9,201 FTEs by 2019. This represents a gap of 35% in 2015 and 31% in 2019, with 62% of this gap in emerging technologies.

Mexico

Mexico has maintained certain economic stability that has been a key factor for continuing IT investment. The government has put in place several strategic initiatives directed at ensuring connectivity in the country. Structural reforms in key sectors of the economy in energy, manufacturing and telecommunications, has promoted direct foreign investment that are working towards a modernization of the productive

processes in the country. Trade with the US has damped a negative effect in the Mexican economy by the recent drop in oil prices.

Mexico is one of the countries in the Latin America region with higher proportion of companies with in-house management of their network infrastructure. This is mainly due to the weight of midsize companies in the country's economy, which favor this option over outsourcing, even in relatively basic aspects of networking. Also network organizations in Mexico could improve their productivity, since the country is only second to Argentina in terms of the average number of networking staff per company.

Security is a factor of great importance for Mexican companies, which dedicate on average, close to 4 people in cybersecurity teams. However, the focus of the professionals in this team is directed towards covering web and end point security, not in security and vulnerability management.

In Mexico, companies find it difficult to find good professionals with the right skills combination. Therefore, it is frequent to hire staff with less than 2 years of experience, followed by training. However, training is still low, and one in four employees leave their company due to lack of training. Mexican companies value in their teams, solving problem skills, team work and communication skills.

IDC estimates that the IT market in Mexico will grow with a 3.5% in CAGR in the 2015-2109 period. The model determined a gap of 157,934 FTEs in 2015, second only to Brazil, slightly decreasing to 148,052 FTEs in 2019. This represents a gap of 40% in 2015 and 33% in 2019, with 49% in emerging technologies.

Peru

Peru has shown sustained growth rates in the last decade. The projected growth of GDP is expected to be maintained around the 4% mark. The country has developed several strategic projects aimed at rapidly improving technology adoption in companies, and to improve the telecommunications infrastructure.

Peru leads the region in the proportion of companies that manage their network internally, with only 21% outsourcing their operations. 44% of companies see a more strategic role of the network, second only to Brazil, and there is a strong emphasis in emerging technologies investment. Peru is the country in Latin America with more development of cybersecurity teams, with 91% of companies indicating the importance of having these teams in place.

Although the difficulty to find qualified professionals is still moderate in Peru, and companies tend to look for fully trained staff, a 42%, significantly higher than the Latin America average, 33%. It is also expected that the gap in emerging technologies will increase greatly in emerging technologies, so companies will be focusing more in the development of those skills in their staff. Retention is one of the highest in Latin America, with 56% of companies not having problems retaining their staff, making this specialization a topic high in the agenda of Management.

IDC estimates a growth in the IT market of 5.5% CAGR in 2015-2019. The model projects a gap of 15,531 FTEs in 2015, progressing to 17,148FTEs in 2019,

representing a 38% gap in 2015 and 31% in 2019. 94% of this gap is expected in emerging technologies.

Venezuela

Venezuela has been subject to impressive economic challenges, which have resulted in the government sector to play an increasingly important role in the economy. Economic and political instability have resulted in the abandonment of a majority of technology vendors of operations in the country, a space that has been filled by companies from China and other countries with a preferred status with the current administration.

Many skilled professionals have left the country, looking for opportunities elsewhere. As a consequence, the supply of skilled professionals is rapidly decreasing, making outsourcing a very viable option to counteract this trend. The country is lagging in new technology adoption, which gives more importance to skills in essential technologies.

The economic environment also makes training and specialization of professionals very difficult, even more considering currency restrictions. Companies tend to consider new professionals with less than 2 years of experience, and University programs as the main source for those professionals. Retaining skilled professionals is not a major problem for companies in Venezuela, given the relatively lack of work opportunities in the country.

IDC estimates that the IT market in Venezuela will decrease by -5.2% CAGR in the 2015-2019 period. The model indicates that, in 2015, there was a gap or deficit of 7,826 FTEs in Venezuela, which will grow to 23,167 FTEs in 2019. This represents 33% in 2015 and 56% in 2019.

CONCLUSION

IDC has identified a gap between the demand for skilled networking professionals, and the number of professionals that are available through Latin America. This gap, however, is projected to decrease relative to the total demand in the majority of countries in the region, with the exception of Venezuela, where a persistent economic and political crisis drives professionals out of the country to look for opportunities.

There are some factors worth noting that drive the decreasing trend of the networking skills gap. The new ICT market dynamics signal a more stable growth, different from the acceleration of demand in the Latin America market of recent years. Also, government in most countries have programs in place that are directed to close the digital divide, to promote the approach between academia and industry, and to develop the technology skills through tertiary education. New business models, and the introduction of technologies that are enabling an optimized operation, are also reducing the requirements of network professionals.

Companies surveyed indicated that the value of certification still represents a business differentiator. However, cost continues to inhibit the certification of a larger portion of professionals. With an increased interest and investment in the 3rd platform,

the need for skills in new technologies increases its importance and is an area where companies, vendors and governments should direct their attention.

Although finding the professionals with the right combination of skills is the biggest challenge for companies in Latin America, compensation is becoming a key factor in hiring and retaining staff. Companies should also ensure the professional advancement of their staff, a frequent cause for professionals to leave the organization. Retaining the staff becomes even more important, since more and more companies are choosing to hire professionals with less experience and invest intensively in training.

Organizations in Latin America also look for a complete set of skills in their network professionals. Proficiency in cybersecurity, data center and in SW development are becoming more important, as well as non-technical skills, such as the ability to work in teams, problem solving and proficiency in the English language. Although there is still room for improvement, women are also an integral part of the network organizations.

Companies are still looking for people with the right set of skills, facing many challenges along the way. In order to correctly address these challenges, IDC recommends the following:

Product strategy

☒ Focus product development by country considering necessities for each country to reinforce essential, emerging and cross technologies´ training.

☒ Make cybersecurity course a module embedded within essential technologies' training

☒ Further develop channels to market for technical education by putting greater focus on e-learning and training through business partners

☒ Develop special programs for service providers' staff so that they can provide certified support to their final customers

☒ Consider including further soft-skills training, especially in problem solving, team work, creativity and innovation, and in the development of communication skills

Communication strategy

☒ Educate businesses in the fact that value to the organization is created through knowledge

☒ Raise awareness by participating in industry events and education forums

☒ Promote benefits of certification, highlighting impact on business results

☒ Develop special campaigns focused on the importance of skills in emerging technologies, in particular in the areas of cybersecurity and SW development

Alliances and Partnerships

- ⊡ Local educational institutions: Diversification between technical and business-oriented universities / post-graduate programs is highly desirable

- ⊡ Local governments: Consider embedding programs as part of digital agenda plans

Consider a joint communication effort with large VARs (Value Added Resellers) and System Integrators (i.e. Dimension Data, Promon Logicalis, etc.) to expand competency programs to their own partner ecosystems

APPENDIX

IDC's Proprietary Skills Model

Model Methodology

In addition to collecting data through the survey, IDC used its Skills Model to provide quantitative data to assist in developing an accurate picture of existing and future demand for networking professionals.

To ensure the accuracy of the model's outputs, and allow results to be compared across countries, the following criteria were followed:

- ⊡ Only statistical information from reputable sources was used. These statistics must have been available in a wide range of countries to ensure consistency.

- ⊡ The model must take into account economic developments in each country, based on both historical data as well as forecasts from IDC trackers: Latin America Enterprise Networks Systems Tracker, Latin America IT Services Tracker, Latin America Unified Communications Tracker, Latin America Software Tracker, Latin America Business ICT Tracker, Latin America Cloud Computing Technologies, Latin America Server Virtualization Tracker, Latin America Emerging Markets Tracker, Latin America Mobile Devices Tracker, Latin America Security Appliances Tracker, Latin America PC Tracker, and Worldwide Black Book. It must also take into account employment and unemployment rates in Latin American countries.

- ⊡ The model must take into account enrollment and graduate data for higher education as these are indicators of current and future potential skills availability.

- ⊡ The model must form part of a holistic view of the IT technology and workforce markets to ensure that there is no "sub-optimization."

As a first principle in developing the model, IDC established 2011 as a baseline year, since several factors are known or, at a minimum, have high confidence factors attached, e.g. GDP in each country, employment/unemployment rates, IT spending, IT services spending on network and security related services, network and security related shipment data and others.

Forecast for supply and demand of skills have then been developed based on several data points and predictions from IDC and recognized international sources.

Assumptions

As with any forecast and model exercise, several assumptions have to be made, whose accuracy can usually only be established with a hindsight view.

Several occurrences can affect the forecast:

⊠ Better or worse economic conditions in the countries than are currently expected.

⊠ Sudden technology shifts (and therefore have not already been taken into account in IDC's forecasts),

⊠ Government policy changes that support or suppress IT spending (examples of existing policies are regulatory changes, austerity decrees, nationalization acts or others)

⊠ Improved performance of the IT services sector, which will stimulate demand for skills – and as experience has shown – attractiveness of IT-related education.

However, it is IDC's opinion that the model and the underlying assumptions are sound and realistic at the time of publication of the data.

Glossary

The definition of *networking skills* used in the model is: people needed to plan, design, manage and support the networking technologies in the organization. The definition of skills needs to be broad due to the proliferation of networking technologies in organizations of all sizes. IDC further uses the following two classifications of skills:

⊠ *Full Time Equivalents (FTEs):* IDC's model is based on assessing the demand and supply of full time equivalent networking skills, since this provides the most reliable foundation for modeling. Full time equivalents are defined as spending 100% of their time working with the networking technology.

⊠ *Skilled People*: However, it is clear that most people with networking skills do not spend 100% of their time working with networking technologies. On average, staff with networking skills also performs peripheral tasks, including PC software and hardware installation, and desktop support. Consequently, for this study, IDC defines skilled people as people that have, as part of their job function, involvement in the planning, design, management and support of networking technologies.

⊠ *Skilled People Gap*: This is the number of skilled people needed to close the skills gap.

- *Labor supply*: Forces relating to the expertise or skills needed to support the market, such as IT or telecommunications engineers, technical support specialists, field engineers, product developers and designers, managers and other professionals, and skilled implementers. At the beginning of some markets, the availability of skilled professionals may be a gating factor -- e.g., Professionals with networking skills in the market for IP Communications or data and RF engineers in the implementation of wireless networks.

- *CAGR:* Compound Annual Growth Rate or Cumulative Annual Growth Rate.

- *Service Provider*: A company that transports information electronically. This category includes Telecommunication Service Providers (TSP), Competitive Local Exchange Carriers (CLEC), Long Distance Carriers (LDC), Internet Service Providers (ISP), Value Added Resellers (VAR), Local Exchange Carriers and Mobile Service Providers.

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