MOBILE WORLD LIVE

ANNUAL INDUSTRY SURVEY 2017

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Tech Mahindra

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MOBILE WORLD LIVE

EXECUTIVE SUMMARY

This year, there are great expectations for and of the mobile industry. The industry is embarked on a technological transformation that will see its infrastructure virtualise – using network functions virtualisation (NFV) and software defined networks (SDN) – and become more flexible and sustainable from an operational cost point of view. This flexible, nimble infrastructure will enable the concept of the network-as-a-service and will go hand-in-hand with the emergence of 5G as the next generation of cellular technology.

These shifts were highlighted in our survey, in which 96% of respondents said they expect 5G to be widely available in their markets by 2025 at the latest, with 31% expecting 5G to be mainstream by 2020. Of course, 5G is new and challenging and roll-out will be complex but it was cost and not technology that was seen as the greatest barrier by respondents, with 38% identifying the cost of deployment as the greatest challenge to 5G uptake.

The other and probably more immediate technological challenge is virtualisation. Big questions remain as to how and when this will be achieved, even if the industry's direction of travel towards NFV and SDN is set. The positive news is that 45% of our respondents said they think virtualisation will bring costs down to a sustainable level but 43% are not sure this will happen. The large share of respondents who are not sure about the ability of the technology to help operators redefine their costs bases suggests a need for further education as to the benefits of this technology. It will be interesting to see the extent to which this uncertainty disappears in surveys in coming years.

Finally on the infrastructure front, the changes being ushered in by 5G and virtualisation mean operators are re-assessing their IT systems. Going through a technical transformation is nothing new for mobile operators. They have always moved from bearer technology to bearer technology as new generations of demonstrably better technology become available. However, these have often made similar demands on operators' IT systems. This time, with virtualisation and 5G, the network becomes more software and IT-oriented than ever before.

This, coupled with many operators' already-ageing back office IT systems, or BSS/OSS, means many are considering the need for full-scale IT system replacement. A majority of our respondents – 66% – see the need for this and, while it would previously be unheard of for an operator's IT team to consider the risks of full-scale deployment, it seems to be understood that the clock is ticking and existing systems will no longer be fit for purpose in the virtualised, 5G future.

Aside from infrastructure challenges, mobile operators are also facing severe security challenges and are associated in users' minds with providing secure services. The largest proportion of our respondents – 37% – identified security as the biggest issue facing the mobile industry this year. In addition, 61% of respondents said they saw mobile operators as being responsible for securing the mobile ecosystem.

Moving on to the services arena, Internet of Things is now a mainstream topic for consideration and it was seen by 48% of our respondents as the most attractive business area for 2017. Encouragingly for operators, they're expected to play a substantial role and 57% of our respondents see operators as a critical part of the IoT ecosystem. Challenges certainly remain in terms of achieving revenues in IoT but operators have the assets and the attributes to generate significant revenues here.

They certainly need to if respondents' attitudes to voice services are correct. Almost exactly half – 49.9% of our respondents - said voice is now a low-value, bundled service and 16% said it has no future as a source of revenue. That isn't news for operators but it does set out how quickly they need to find new areas to generate revenue from.

Nevertheless, operators are still seen as providers of critical infrastructure and enablers of the mobile ecosystem. 88% of our respondents confirmed that mobile technology is seen as an enabler of access for all.

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THE STATE OF THE NATION

Sponsor's Comment: Tech Mahindra

"The GSMA's Mobile World Live survey shows that more than 70% of respondents feel operators are either greatly or somewhat committed to NFV.

The result shows growing consensus that NFV is the way forward to build virtualised, elastic and agile networks, and is the bedrock for 5G. Adoption of NFV helps operators to cost effectively cope with growing traffic demands and create hyper-scale, software-centric networks.

While NFV & SDN technologies have matured, there still are many challenges including lack of standards, integration risks, multitude of available alternatives and unproven end-to-end solutions.

Tech Mahindra has risen to the challenge with its VNF-Xchange: a vendor-neutral certification platform built to accelerate NFV deployment. VNF-Xchange validates various components of the NFV solution stack. VNF-Xchange validates Virtual Network Functions (VNFs) and more broadly validates end-to-end solutions and use cases.

VNF-Xchange eliminates risk, offering a portfolio of pre-integrated, pre-certified end-to-end partner products with clearly characterised performance.

VNF-Xchange: Accelerating NFV!"

Manish Vyas, Global President, CME and Chief Executive, Network Services, Tech Mahindra

We began this year's survey by asking our respondents what they saw as the biggest issue facing the mobile industry.

Unsurprisingly, given the number of highly publicised corporate and personal hacks that hit the headlines in 2016, 37.1% of our respondents selected security as the biggest challenge the industry has. Concerns are real and most recognise there is nowhere to hide and attacks will proliferate as the threat surface widens and encompasses connected vehicles and other sensors and devices in the Internet of Things.

The only other challenge to be selected by more than 10% of respondents (15.1%) was market saturation. For mobile operators across the world, it's a case of job done with more than 100% saturation of at least 2G mobile in major markets. The problem is that's based on a business model from a previous decade – in some advanced markets, two decades ago. A fully addressed market radically lowers mobile operators' abilities to achieve growth because there are no new customers to address. Growth now is only available by attracting customers from rivals while retaining the ones they already have and from getting a greater spend from each customer.

The next most popular concern was also business-related. 9.8% of respondents cited commoditisation of mobile network services as their biggest issue and this awareness of dwindling profitability from their core services was compounded in the fears of a further 9.3%, whose greatest concern was over-the-top (OTT) players. This reflects fears that OTT players will reap the greatest share of new service revenues while still requiring operators to provide the connectivity at a commoditised rate.

Technical issues were less of a concern, with spectrum availability singled out by 8.4% of respondents as their biggest worry and virtualisation and NFV the greatest challenge for 7.7% of respondents. These figures reflect a generalised awareness that technological answers either already have been found, or soon will be, to address these challenges.

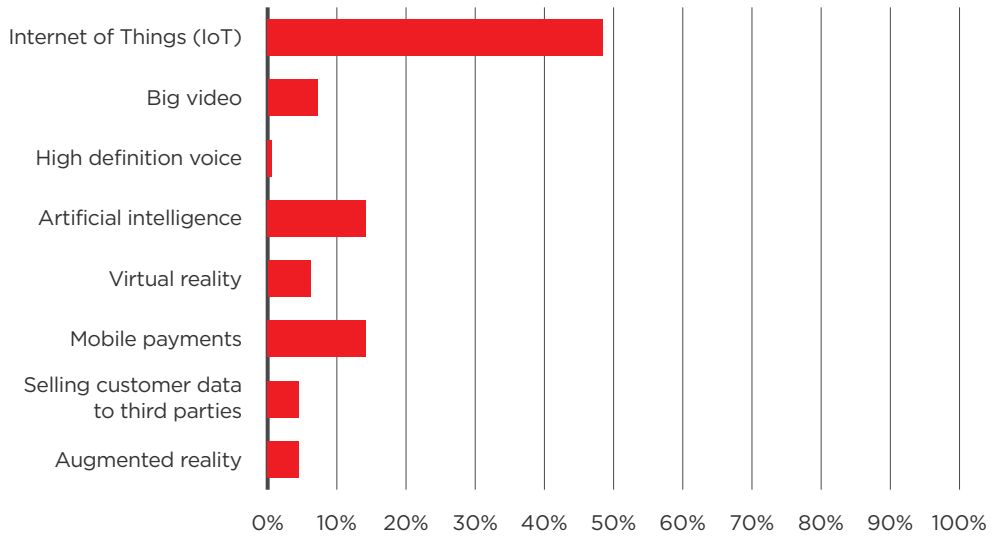
Biggest opportunities

Next, we asked which new business areas will be the most attractive in 2017. By far the largest proportion of our respondents (48.2%) selected Internet of Things (IoT). The highlights the sheer volume of connections, in the tens of billions according to all analyst firms, expected but also the opportunity for mobile operators to play a greater role in the IoT value chain than simply providing the connectivity.

The next largest opportunity was mobile payments, chosen by 14.5% of respondents. Mobile payments are already gathering momentum in many developed and developing markets and this acceleration is set to continue as device makers, such as Apple, drive familiarity with paying for goods and services using mobile devices.

A similarly large proportion of respondents (14%) selected artificial intelligence as the most attractive new business area in 2017. This was augmented by the 6.3% who selected virtual reality, demonstrating that these technologies and the rich experiences and efficiencies they can offer are gaining traction. 2017 may be too early for mainstream takeup, but opportunities will emerge.

Which new business areas will be the most attractive in 2017?



M&A activity

We then asked whether our respondents see accelerated mergers and acquisition (M&A) activity among mobile operators in 2017. Almost two-thirds (62.9%) of respondents said that they did, perhaps seeing market saturation as driving a new wave of consolidation or looking at the economies of scale of offering a global footprint to support IoT services or a quad play portfolio.

The move to NFV

Next we turned to explore in more detail respondent attitudes towards virtualisation and telco cloud. We asked to what extent respondents think mobile operators are committed to deploying network functions virtualisation (NFV) technologies. There was significant awareness of the technology, demonstrated by the 25.7% of respondents who felt that operators are greatly committed to the technology and the 46.6% who felt that operators are somewhat committed to NFV. However, the message of the benefits of a fully-virtualised infrastructure has not got through to all our respondents. 26% said that operators are only committed to deploying NFV in isolated areas of their businesses and, perhaps demonstrating that most understand there are at least some advantages, only 1.6% said mobile operators are not committed at all to the technology.

We delved further into respondents' perceptions of NFV and asked whether they thought virtualisation, enabled by NFV and SDN, provide the means for mobile operators to bring their cost of operations down to a sustainable level. 11.9% thought the technology would not help in that effort but 45.2% did, demonstrating that the cost efficiency benefits of virtualisation are understood by almost half of respondents. However, there's still an education job to be done with 42.9% of the respondents saying they were not sure that virtualisation technologies will enable mobile operators to bring their cost of operations down.

Part of the motivation for virtualisation is its capability to bring down the cost of network operations and provide greater flexibility in allocating network resources. This will be vital as big video and ultra high definition video technologies come to market. We therefore explored respondent attitudes to how mobile operators will monetise provision of such services in our next question. We asked whether it's fair that operators are expected to provide the network capacity to support such bandwidth-intensive services.

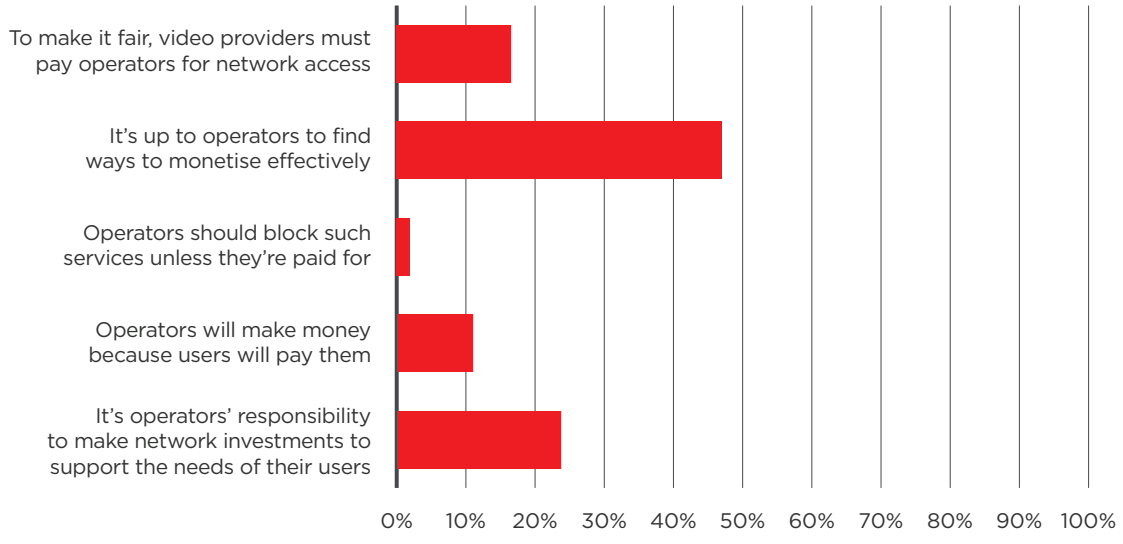
Pressure on operators

Respondents had little sympathy for the burden this places on operators and the largest proportion (46.8%) said that it's up to operators to find ways to monetise effectively. A further 23.3% said that it's operators' responsibility to make network investment to support the needs of their users, placing the burden of supporting such services squarely in the operator domain.

However, some respondents did feel that operators would be fairly compensated for providing the infrastructure to support such services. 11.6% said operators will make money from these services because the users will pay, while 16.6% said that, to make the situation fair, video providers must pay for network access.

Even so, a small proportion of respondents (1.75%) didn't see video providers or consumers paying operators enough to justify the huge network consumption involved. These respondents instead advocated that operators block such services unless they are paid for supporting them.

As ultra high definition video technologies come to market is it fair that mobile operators are expected to provide the network capacity to support such bandwidth intensive services?



> "We asked which new business areas will be the most attractive in 2017. By far the largest proportion of our respondents (48.2%) selected Internet of Things (IoT)."

Mobile payments

On the subject of monetisation, we next asked our respondents what they saw as mobile operators' roles in the mobile payments ecosystem. A large role was seen for operators here. 39.2% of respondents said that mobile operators' role should be to support banks and financial institutions, while 34.5% said that operators are trusted payment providers in their own right. However, some were sceptical, with almost 10% saying that operators shouldn't have a role in mobile payments and 16.3% saying that consumer brands, such as Apple, are better placed than operators.

The future of voice

It's clear from these responses that the market is still grappling with how mobile operators will either provide or support new types of services but as they do this, they continue to make the bulk of their revenues from traditional voice services. We therefore asked our respondents what they saw as the future of mobile voice communications. Worryingly for operators hoping to extend the lifespan of voice, 49.9% of our respondents said that voice is a low value, bundled service. A further 15.7% said voice has no future and revenues will dwindle as users turn to other communications formats.

There were also some positive responses. Just over one-quarter (25.2%) of respondents said voice will continue to be the core of the mobile market for many years to come, while 9.1% of respondents said that operators can generate revenues from services such as high definition voice.

The enabler of access for all

We moved on to explore how respondents view mobile technology itself and asked whether they see it as the enabler of access for all. A resounding majority of 88.4% of respondents said that they did, demonstrating the ease of buying a mobile device and using it to connect to the internet. Just 11.5% disagreed.

Data sharing – a trust issue

Finally in this introductory section of the survey, we asked respondents whether they would trust or allow their mobile operator to share their data with third parties. A majority of respondents (54.3%) were willing to do so but only for data that they have approved to be shared. The next largest proportion (23.5%) also were willing to share their data but only when they have opted in to do so. These results demonstrate good respondent understanding of the value they can derive from operators' using their data but also strong awareness that sharing data without having protections and limits in place is a security and privacy risk.

This was emphasised by just 3.7% of respondents saying they would be happy for all their data to be shared, perhaps demonstrating lack of awareness of the risks of doing so. At the other extreme a cautious 18.6% of respondents said they would never allow their mobile operator to share its data with third parties. These respondents may have seen too much bad press about data and privacy breaches and, regardless of the potential value operators can provide them if they share their data, they have decided to shut down and not participate.

> "Unsurprisingly, given the number of highly publicised corporate and personal hacks that hit the headlines in 2016, 37.1% of our respondents selected security as the biggest challenge the industry has."

> "Worryingly for operators hoping to extend the lifespan of voice, 49.9% of our respondents said that voice is a low value, bundled service."

5G

Although mainstream 5G deployment remains many years away, 2016 saw substantial work completed that will aid further development of the technology and help to commercialise it.

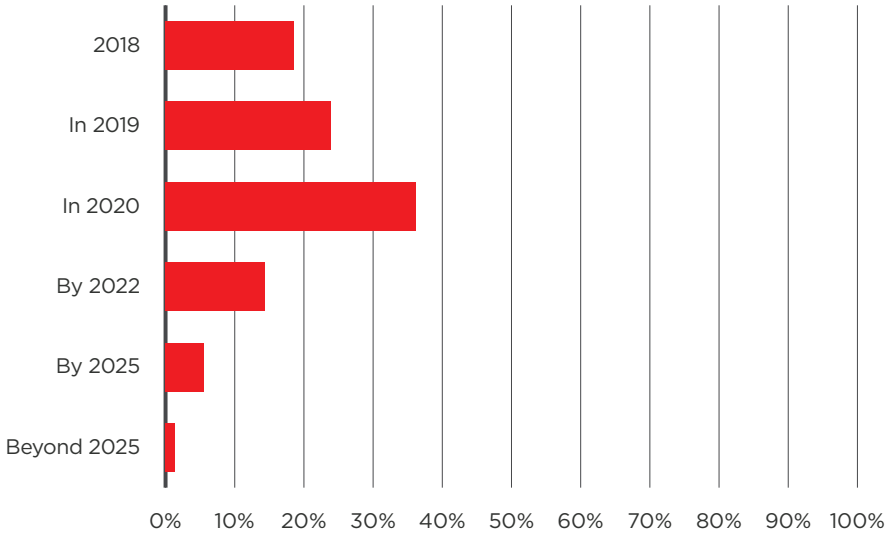
The bandwidth demands of big video and the Internet of Things (IoT) have meant there is accelerated demand for greater mobile network bandwidth and, with 4G/LTE only now completing deployment, it's understandable that vendors' and operators' attention turn to what's coming next.

5G, however, is a far more complex migration than that of 3G to 4G and the expectation of its imminent arrival is likely to be over-enthusiastic at best and unrealistic at worst. We asked our respondents when they expect 5G connectivity to be widely available in their market. The largest proportion of respondents (46.7%) accepted that more development time is needed and expect the technology to be widely available in their country by 2022. That gives vendors almost five years to refine their technologies and allows operators some time to establish how to deploy 5G technologies at scale.

However, some were thirstier for the increased capacity and throughput 5G technologies offer and 30.7% said they expected 5G to be widely available in their markets by 2020. This, perhaps, reflects greater enthusiasm for the technology than the reality can keep pace with. Similarly, 18.7% of respondents said they expected the technology to be widely available in their market by 2025. These respondents are not necessarily pessimists but they have a strong awareness of the varied deployment challenges associated with 5G roll-out.

Nevertheless, most respondents are confident that 5G will be widely available in their markets within a decade. Only 3.9% of respondents expect mainstream availability to take longer than 2025 in their markets.

When do you expect the first commercial deployments of 5G to happen in your market?



First launches

Widescale deployment remains a relatively distant prospect but early commercial deployments indicate the pace at which the mainstream market will be addressed. To explore this further, we asked when our respondents expect the first commercial deployments of 5G to happen in their markets. A substantial proportion of 17.9% said they expected this to happen in 2018, while 23.5% expect early commercial deployments in 2019. The largest proportion – 36.4% – foresee the first commercial deployments happening in 2020, demonstrating that more than three quarters of respondents (77.8%) expect first commercial deployment of 5G to have happened in their market by the end of 2020.

This expectation will force the rate of development but reflects the appetite of respondents for the coverage and throughput that 5G technologies can enable. Nevertheless, there were those more cautious about the timescale for deployment. Perhaps these respondents are new to 4G or recognise that time will be required for the technologies that make up 5G to mature or for investment resources to be built up. Among our respondents, 5.9% felt that first commercial deployments would happen in 2025 and just 1.4% felt that these would happen beyond 2025.

This paints a picture of fast 5G development followed by rapid roll-out. The mobile market needs the technology but it's clear from our respondents that the pace will be fierce.

In order to understand the reasons for the expected fast pace of 5G roll-out, we asked our respondents whether the speed and throughput of 5G is necessary. A large majority (70.9%) said that it is, while just over one quarter (25.5%) of respondents felt that the capabilities of 4G/LTE are sufficient. Just 3.6% of respondents argued that 5G isn't necessary.

> "Simply saying more speed and throughput will be available just isn't enough. Mobile operators want to know what new services and revenues they can generate as a consequence of having 5G networks before they sign off on the investment."

Greatest barriers

In spite of their enthusiasm our respondents are aware of the challenges that 5G deployment presents. We asked what they saw as the greatest barrier to 5G deployment and the cost of roll-out was selected by the largest proportion – 38.1% – of respondents. For mobile operators, cost is a significant pressure coming so soon after the industry's multi billion dollar investments in LTE.

The next most identified barrier to 5G deployments – selected by 22.3% of respondents – were the lack of clarity surrounding 5G use cases. There's a likely feeling among respondents that too much vagueness exists around what 5G networks will be used for. Simply saying more speed and throughput will be available just isn't enough. Mobile operators want to know what new services and revenues they can generate as a consequence of having 5G networks before they sign off on the investment.

A further issue that gathered significant attention was spectrum availability. 19.2% of our respondents saw this as the greatest barrier to 5G deployment, perhaps still unsure that refarming of spectrum from other services, notably 2G networks as they are retired, would be sufficient to enable 5G networks to perform to their maximum.

Final areas of concern were lack of standardisation, selected by 11.3%, and technical innovation, chosen by 9.2% of respondents. This fifth of the respondent-base showed that technical concerns are real, even if the majority of the respondents are focusing on other challenges to 5G deployment.

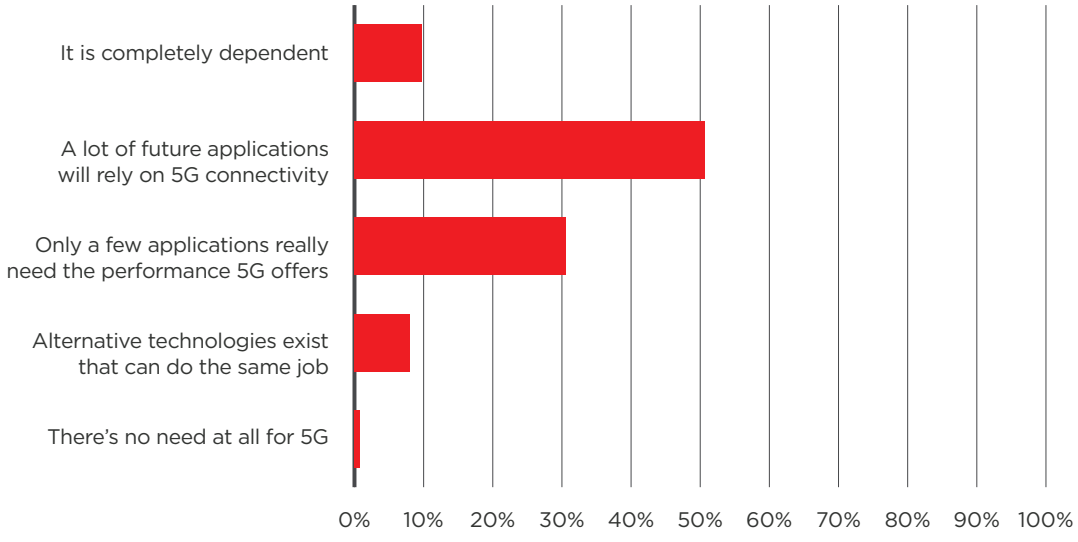
Respondents, in spite of their expectations for rapid deployment, were more divided on whether or not 5G is overhyped. 57.8% said they thought it was, while 42.2% said it wasn't. Hype and overhype in particular doesn't mean something is wrong, it just means hype is present so, in a survey of this type, it's possible that respondents can select an early date for commercial deployment of 5G while agreeing the technology has been overhyped. Only time and the deployment reality will truly reveal the extent to which 5G has been overhyped. However, the existence of at least some hype is not in doubt.

Dependence on 5G

Next, we asked our respondents to what extent the future connected world is dependent on 5G. A majority (50.6%) said they expect a lot of future applications to rely on 5G connectivity and 9.9% said the future connected world is completely dependent on 5G, but others were more circumspect about the role and importance of 5G. Another large proportion of respondents (30.5%) said that only a few applications really need the performance 5G offers, while 8.3% said that alternative technologies exist that can do the same job. A barely traceable proportion of respondents (0.7%) said that there is no need at all for 5G.

This split in attitudes to the technology is symptomatic of different paces of development in different markets. Advanced markets can already see 4G/LTE running out of capacity to support applications such as big video, while latecomers to LTE are still imagining services that will completely fill up 4G networks and their software-enabled planned upgrade paths.

To what extent is the future connected world dependent on 5G?



> "More than three quarters of respondents (77.8%) expect first commercial deployment of 5G to have happened in their market by the end of 2020."

Main uses cases

With the division in responses to whether the future connected world is dependent on 5G in mind, we next explored what our respondents see as the main use cases for 5G. We asked them to select all that apply from a list that included (and multiple selections were allowed): ubiquitous broadband access, media services, smart vehicles, human-to-IoT interaction and urban wireless coverage.

Similar proportions of respondents chose ubiquitious broadband access, smart vehicles and human-to-IoT interaction, suggesting these use cases will create the most 5G traffic. However, they reveal differing perceptions of what 5G will enable. In markets where broadband access is already ubiquitous, 5G may be less significant as users rely on fibre, Wi-Fi, 4G cellular and satellite technologies to broadband-enable themselves. However, in other markets, 5G may be the only viable broadband access option.

Equally, many would argue that human-to-IoT communications will involve relatively low amounts of bandwidth. It's not bandwidth intensive to instruct a remote thermostat to raise the temperature in your living room by a few degrees, for example. However, the bandwidth availability of 5G may be vital for an engineer remotely repairing a pipeline using a high definition video feed and controlling a robot over the network. The variance probably exists because some believe that 5G will enable new ways of living which will only become apparent when the technology is available and others are looking at how 5G can augment and add to current use cases.

The proportion of respondents that selected utilisation of 5G for smart vehicles is also worth examining. Technologies such as mapping, communications and infotainment are already well handled by a combination of satellite and 3G networks. However, new applications such as autonomous driving will require greater coverage and capacity – not necessarily 5G. 5G could augment existing approaches here but concepts such as convoying of trucks will need a faster, line of sight connection than 5G can guarantee. As with so many aspects of 5G, the use cases here are still not fully defined.

Outside the leading three responses, media services were selected by 37.3% of respondents as a main use case for 5G. There are clear applications for 5G in media services, especially as ultra high definition video services come to market which will place greater demands on networks. In addition, ever-increasing bandwidth is required by gamers and for augmented or artificial reality games.

Finally, 30.3% of respondents said that a main use case for 5G would be in providing urban wireless coverage. For the reasons outlined above urban networks, because of their population density, will place the most concentrated demands on mobile networks and 5G looks to have a role in taking the pressure off 4G and earlier generation infrastructure.

> "30.7% expect 5G to be widely available in their markets by 2020. This, perhaps, reflects greater enthusiasm for the technology than the reality can keep pace with."

> "Similar proportions of respondents chose ubiquitious broadband access, smart vehicles and human-to-IoT interaction, suggesting these use cases will create the most 5G traffic."

SECURITY

It's no surprise given the stream of well-publicised breaches and attacks over the last 18 months that security is now at the top of everyone's minds and in their digital lives in particular.

It doesn't matter if you're using a dating website, syncing your mobile device to your car's infotainment system, shopping or giving your mobile operator payment or personal information, all these sectors have been hacked by cyber criminals.

This state of affairs isn't set to change as the attack surface widens and encompasses IoT devices, carelessly secured mobile devices and arcane security 'back doors' such as tyre pressure monitoring systems (TPMS) in connected cars. The only positive news is that the risks are well known and companies of all types are taking security seriously.

With this sombre landscape in mind, we asked our respondents who is responsible for securing the mobile ecosystem. The vast majority (61.2%) believe mobile operators are responsible, placing the responsibility squarely on them, although operators have little or no control of what users do, what organisations they interact with and who they share personal information with.

The blame among our respondents lies squarely in the network, with the next most widely selected type of organisation selected by respondents as responsible for securing the mobile ecosystem being network equipment vendors, chosen by 10.3%. These figures suggest an unwillingness to engage with all the issues that surround mobile ecosystem security and a hope by respondents that responsibility can be placed at mobile operators' doors exclusively.

In reality, of course, it can't, but our respondents seem to be looking everywhere but at their own, their companies' and their governments' efforts, in order to place responsibility elsewhere. Just 1.3% of respondents said the responsibility for securing the mobile ecosystem lay with consumers, while 2.5% said it lay with enterprise. Surprisingly, just 7.8% felt governments are responsible for securing the mobile ecosystem, and even the vendors of security systems were not widely selected, being chosen by just 7% of respondents.

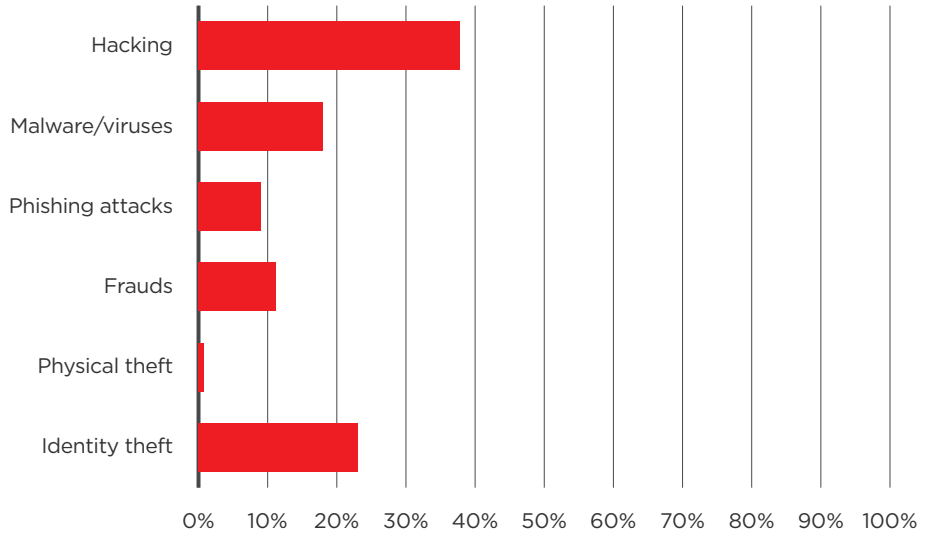
Regardless of the security realities, respondents expect their mobile operators to keep them secure and the mobile industry will have to address this if they are to continue to maintain the trust of their customers. To understand more about respondents' perceptions of security we asked them what they see as the greatest threat.

Biggest security threats

Hacking was selected by the largest proportion – 37.6% – of respondents, with identity theft, chosen by 23.3% of respondents, seen as the next greatest security threat. A significant proportion (17.7%) selected viruses and malware as the most significant threat, closely followed by fraud, selected by 11.6% of respondents, and phishing attacks, which were seen as the greatest security threat by 9% of respondents.

Encouragingly for law enforcement agencies and especially in a time when users routinely carry devices with a value greater than US$600 in many markets, physical theft was seen as the primary security threat by less than one percent (0.9%) of our audience.

What do you see as the greatest security threat?



We then asked our respondents if they felt that security concerns were overhyped. Just 10.7% said that they were, suggesting that the vast majority of our industry believes that concern around the different types of security threat that surround and lie within the mobile ecosystem is fully justified.

"We asked our respondents who is responsible for securing the mobile ecosystem. The vast majority (61.2%) believe mobile operators are responsible."

Best security options

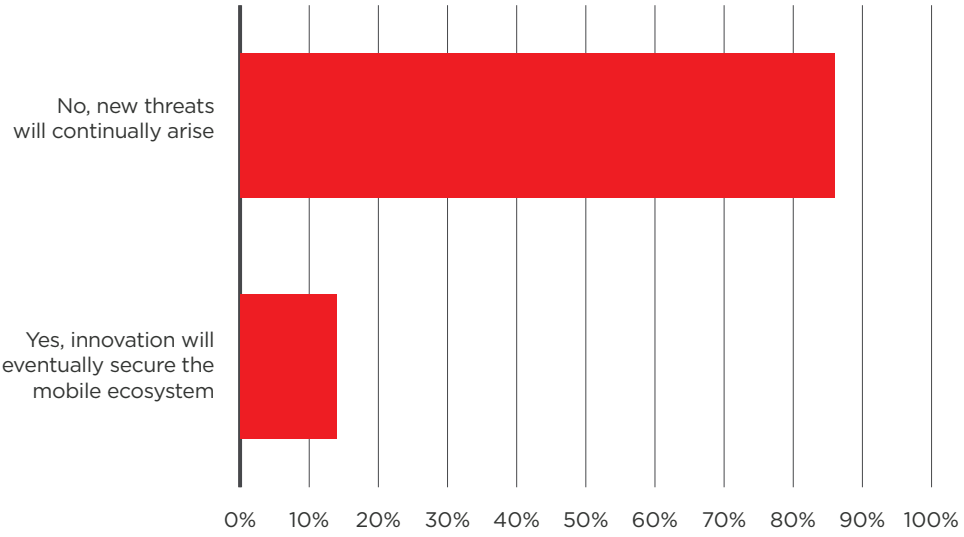
Next we looked to establish respondent awareness of the different means to secure the mobile ecosystem from a list that included (and was open to more than one response): antivirus, firewalls, encryption and biometrics. Encryption was the most widely selected means and was chosen by 72.7% of respondents. Next most popularly chosen were biometrics, which was chosen by 45.9% of respondents, and firewalls, selected by 43.3%. Finally, antivirus software was selected by 31.2% of respondents.

These findings demonstrate that respondents recognise a range of methods and means will be required to secure the mobile ecosystem, and also arguably reveal an acceptance that different types of security is required to protect users and networks from different types of attack.

No security utopia

We then examined whether a truly secure environment can ever exist. The vast majority of respondents – 86.1% – were highly pessimistic, agreeing that a truly secure environment can never exist because new threats will continually arise and cause breaches and technical challenges. Just 13.9% of our respondents felt that innovation would eventually secure the mobile ecosystem, perhaps highlighting an awareness among respondents that a global industry of hackers and cyber criminals has grown up and will continually attack mobile infrastructure and services.

Can a truly secure environment ever exist?



Uniting to fight security

Finally, we asked our respondents whether a global effort is needed to fight threats and achieve security. Unsurprisingly the majority of our respondents – 69% – agreed that criminals must be fought globally. These respondents recognise the global nature of cybercrime and the value of being able to share details such as fraud types and approaches between jurisdictions.

A small selection (6.9%) of respondents felt that national or regional initiatives would be enough to achieve security, suggesting insufficient awareness of the global nature of fraud, hacking and other cyber crimes.

Finally, almost a quarter (24.2%) of respondents argued that everyone must take responsibility for their own security, running counter to respondents' earlier assertion that mobile operators are responsible for securing the mobile ecosystem. This group of respondents does recognise the need for individuals to be aware of their security in the mobile world but appears unaware that a truly secure mobile experience is unlikely to be practical and achieved if all players act in isolation.

> "69% agreed that criminals must be fought globally. These respondents recognise the global nature of cybercrime and the value of being able to share details such as fraud types and approaches between jurisdictions."

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IoT

Sponsor's Comment: Accenture

"The GSMA's Mobile World Live survey conveys that industry participants are thinking intently about the disruptive change that will soon be made possible by the Internet of Things (IoT).

A majority of respondents clearly believe IoT will be an important source of opportunity for mobile operators. In fact, more than half describe operators as a critical piece of the IoT ecosystem.

However, there is still debate about the exact shape of the opportunity. Many believe operators should become providers of IoT-enabling technologies, while others recommend a focus on enabling device scale, and still others a focus on becoming a one-stop-shop for enterprises. A plurality view selling new, IoT-specific capabilities, in addition to network connectivity, as a strong monetisation opportunity.

The respondents evidently agree that for gains to occur, substantial change will be required. A plurality believe IoT will radically change the relationships between network, platform, service and application providers. And nearly unanimously, respondents agree operators will need to transform themselves to take full advantage of the market opportunity.

These results underscore that operators will address the IoT opportunity only if they augment existing capabilities and offerings with new IoT-focused capabilities. Accenture is excited about this evolving industry dialogue, and looks forward to further discussion."

With Internet of Things (IoT) being selected by 48.2% of our survey's respondents in the opening section as the business area they think will be most attractive in 2017, it's clear that this market is now mainstream and seen as an important source of new opportunities for operators. The good news is that operators have much to offer in IoT. We asked our respondents what they saw as the main value that operators can add to the IoT and a long list of capabilities were identified (multiple selections were allowed), ranging from the networks themselves to security, billing, device distribution and newly-developed IoT-related capabilities.

Operators' network capacity was, perhaps predictably, seen as a main value by 54.6% of respondents, 41.3% saw operators' distribution and support networks as a main value and 39.1% identified operators' security capabilities as an important attribute. Operators' global footprints were also acknowledged as a main value by 26.7% of respondents.

The back office was also an attraction, with bill and charge capabilities being selected as a main value by 35.6% of respondents and O/BSS being chosen by 17.8%.

However, while operators' traditional telecoms strengths were recognised as having significant value, new skills were also identified. 42% of respondents agreed that new, IoT-specific capability combined with networks was a main value that operators can provide.

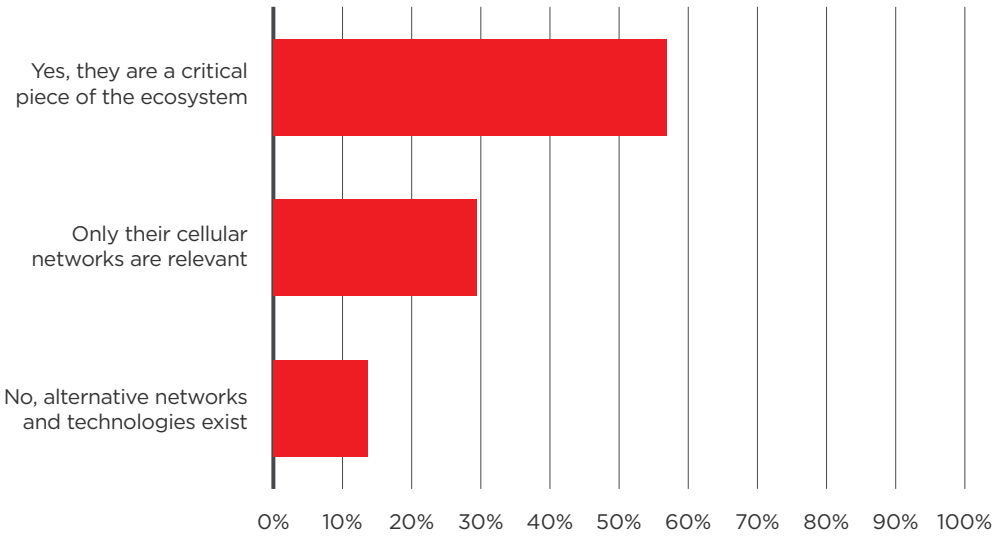
Transforming the operator

We then asked what does a mobile operator need to do to transform itself to support IoT? The majority of our respondents (43%) said that operators should focus on becoming providers of IoT enabling technologies. 21% said they should focus on enabling multi-billion device scale while 18.9% said they should focus on becoming an IoT one-stop-shop for enterprises and 13.5% said they should focus on bringing down costs.

There was only limited complacency that current operator attributes are sufficient to support IoT, with only 3.7% of respondents saying that operators don't need to transform to support IoT.

Operators are seen as having an important role in this space, with 57.2% of respondents describing them as a critical piece of the IoT ecosystem. However, 29.1% of respondents said only their cellular networks are relevant to IoT and 13.7% felt they weren't central to IoT at all and alternative technologies and networks exist.

Are mobile operators central to IoT?



It's clear that operators have substantial opportunities to address the IoT market opportunity if they augment their existing capabilities and offerings with new IoT-focused capabilities. We asked our respondents how they believed mobile operators would attain the capabilities needed and just 8.3% of our respondents said they would do so by making use of their existing capabilities alone.

21.3% felt it would be necessary for operators to add capabilities by acquiring them while 70.4% said a combination of existing internal capabilities and acquiring additional capabilities would get operators the capabilities they need to address IoT opportunities.

IoT network technology battle

We then asked our respondents which network technologies they saw as likely to become the winners in IoT. 5G was most popularly selected with 28.9% of respondents choosing it. Next most popular was narrowband IoT (NB-IoT), chosen by 24.3% of respondents. 4G/LTE was chosen by 14.4% of respondents, perhaps because respondents ultimately expect 5G to supersede it, and Wi-Fi was selected by 12.4% of respondents.

Significantly, the wide array of non-cellular low power wide area network (LPWAN) technologies was only seen as a winner by 10% of respondents, possibly reflecting the fragmentation and lack of standardisation that exists in parts of the LPWAN/LoRa market.

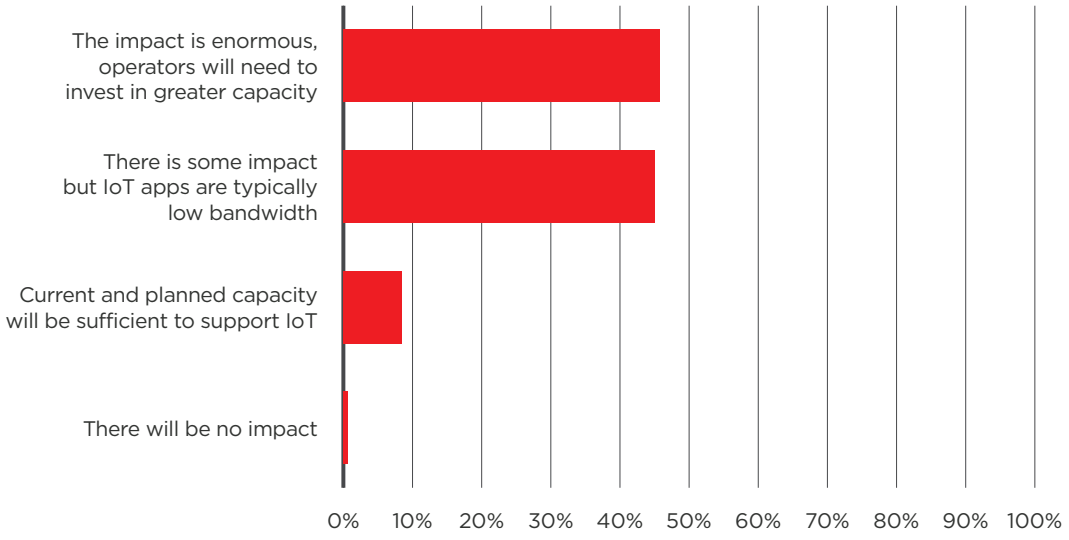
Standardisation itself is seen as an important issue and the vast majority of respondents (62.4%) regard global standards creation as essential if IoT is to become a mass-market success. However, 32.6% of respondents think that standardisation will take too long to achieve and de facto standards will emerge in the interim, addressing the issue. Just 5% of respondents saw no need for standards, with the belief that vendors will succeed by relying on proprietary technology.

Impact on mobile networks

Next we explored the impact on mobile operators of IoT becoming mainstream and scaling up into the widely projected billions of devices in deployment. We asked specifically what the impact of these billions of devices will be on mobile networks and uncovered a split in respondent perceptions. 45.6% of respondents said the impact will be enormous and operators will need to invest in greater capacity. This fits well with respondents' earlier assertion that 5G will be a winning network technology.

However, a division in the respondents' views emerged with 45% also saying that the billions of devices will have some impact but the apps involved typically have low bandwidth demands. 8.7% felt that current and planned capacity would be sufficient to support IoT while just 0.7% expect the billions of IoT devices to have no impact.

What impact will the billions of IoT devices expected to be deployed have on mobile networks?



Given the belief that traffic will increase as IoT matures, we then asked respondents when they expected IoT to become a significant part of operator traffic. The largest group of respondents (51.9%) said this would happen by 2020, a further 36.3% expected this to happen by 2025. An optimistic 3.3% said they thought IoT would become a significant part of operator traffic this year but the pessimists said the mass market wouldn't take off until after 2030 (5.7%) and a further 2.8% said that the mass market will never take off and IoT will remain a niche offering.

> "It's clear that operators have substantial opportunities to address the IoT market opportunity if they augment their existing capabilities and offerings with new IoT-focused capabilities."

> "The results indicate that a revenue generation upside for operators is expected by almost everyone from IoT – it's the size of the opportunity that is open to debate."

IoT use cases

Inevitably for IoT to become a mass-market phenomenon, attractive consumer applications are needed to accompany industrial use cases. To gain greater insight into the likely successful applications we asked our respondents which IoT use cases are being given the most attention by operators today (respondents could select more than one option).

Connected cars (60.6%), connected homes (54.8%) and smart cities (56.1%) were selected by the greatest number of respondents, demonstrating the perceived value of IoT apps in the home, in private vehicles and where people live. However, some vertical markets, notably smart energy (51.1%) and healthcare (40.2%), were also identified as being given significant attention by operators. Both these areas provide opportunities for very significant cost savings to be accrued by consumers and service providers and therefore clear business cases for investment in IoT infrastructure can be made.

Perhaps for similar reasons Industrial IoT/Industrie 4.0, which was selected by 34.6% of respondents, and operational technologies, chosen by 11.7% of respondents, were identified as areas of operator focus. The final area, retail, was selected by 18.5% of respondents, demonstrating the sector's huge footprint, large number of customers and willingness to invest in technology.

New revenue stream for operators

We then asked our respondents how they viewed IoT as a monetisation opportunity for operators. The largest percentage of respondents (43.1%) saw selling new, IoT-specific capabilities in addition to network connectivity as a strong monetisation opportunity for operators, 27.4% saw IoT as an excellent opportunity to effectively monetise the network and a further 16.7% believed operators will generate significant network revenues thanks to the scale of the IoT market.

However, a small number (12%) of respondents felt that operators won't generate anything more than commodity connectivity revenues as a result of IoT and just 0.7% of respondents thought that serving IoT only represents an additional cost for operators.

The results indicate that a revenue generation upside for operators is expected by almost everyone from IoT – it's the size of the opportunity that is open to debate.

Disrupting business models

Finally, we asked our respondents to what extent they felt IoT would disrupt competitive and cooperative business models. The largest proportion of respondents (45.4%) said they believe that IoT will radically change the participants and the relationships between network, platform, service and application providers, demonstrating the extent to which clear roles and responsibilities in the IoT service delivery chain are as yet undecided.

39.7% of respondents didn't think the participants themselves would change but did think IoT will create changes in the relationships between them. This response could be based on the possibility of increased competition between organisations that have previously had clearly demarcated roles, battling for customers as they develop overlapping capabilities. 13.5% of respondents thought that neither the participants, nor the relationships, would change but that IoT will present new ways in which companies compete and cooperate. Finally, a very small proportion of respondents (1.48%) felt that IoT would not affect the business landscape at all.

> "A majority 45% believe that IoT will radically change the participants and the relationships between network, platform, service and application providers, demonstrating the extent to which clear roles and responsibilities in the IoT service delivery chain are as yet undecided."

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"Overall, the responses show that the desire for full scale IT system replacement is much more prevalent today than it was five years ago.

Clearly, the focus is on generating new business value, and consequently more than 30% of operators have the desire to replace their entire IT stack with a greenfield or gradual transformation approach.

This is quite astonishing, considering that full scale IT transformation projects are notoriously risky. The majority of operators had been understandably conservative in the past, tinkering with and customising their existing systems rather than replacing them. But now the imperative of business transformation, along with the need to reduce cost of maintaining patched-up legacy systems, is spurring unprecedented operator interest in full scale IT transformations with a view to switching on the new system as fast as possible to generate new business value. Retiring the legacy could be a gradual process at the higher operational cost of running two systems in parallel."

Michael Wu, CEO, AsiaInfo

As virtualisation via network functions virtualisation (NFV) and software defined networks (SDN) gathers pace, ushering in an era of increased automation and ultimately a DevOps environment for telecoms, IT is pervading networks more than ever before. Traditional IT support technologies, commonly described as operational and business support systems (OSS/BSS), now form just part, rather than the kernel, of an operator's IT estate. In addition, networks now rely on many more IT functions than just OSS/BSS. With this in mind, we explored our respondents' attitudes to the wider discipline of telecoms IT, and the demands the technical transformations of virtualisation and new network technologies and services are placing on it.

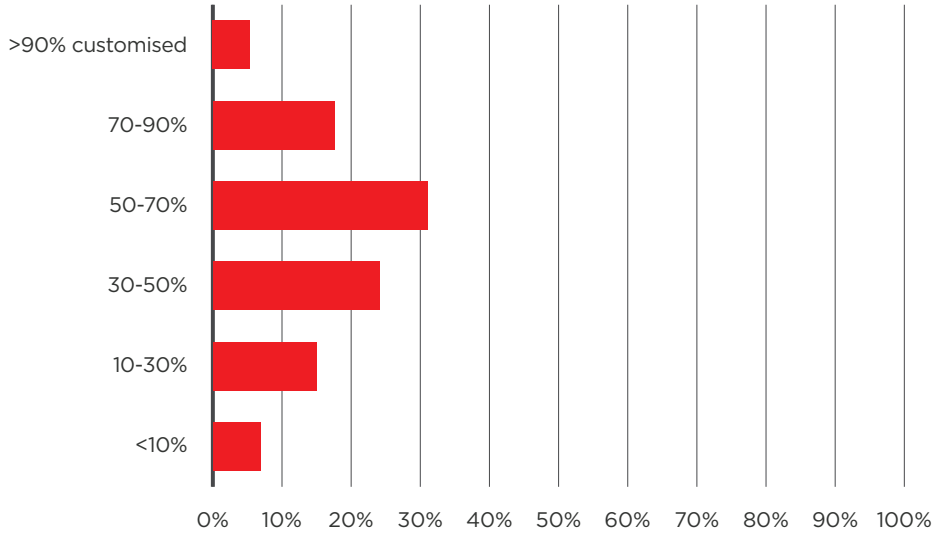
First, we asked our respondents how suitable the best of breed approach to telecoms IT is for the new digital world. For 15.7% of our respondents, the best of breed approach was still chosen as the best approach to ensure the specific specialisms of the telecoms industry are addressed. 4.8% of respondents felt that the best of breed approach is no longer suitable, and 8.8% of respondents said they felt that utilising a pre-integrated suite of IT is usually better. This is perhaps because operators recognise the challenges of integrating best of breed systems in terms of time, resources and costs and want the accelerated time to market that pre-integrated suites can provide.

Nevertheless, the idea that a best of breed approach is sometimes the most applicable, while at other times off-the shelf or pre-integrated systems are most suitable, continues to hold the majority of mindshare, with 70.7% of respondents stating that there are pros and cons to be considered depending on the system involved. This suggests operators are still carefully considering the functionality they need, and are willing to take pre-integrated approaches with more standard software while continuing to look to best of breed systems to address highly specific pain points.

Taking a customised approach

We delved deeper into operators' needs for customised IT systems and asked what percentage of customisation exists in their IT systems today. The largest proportion of respondents (31%) said that 50-70% of their systems were customised, whereas only a small percentage of respondents said their systems were either more than 90% customised (5.4%) or less than 10% customised (6.9%). Clearly, customisation has been necessary in the past but that doesn't mean it is necessarily desirable. In fact, operators generally say they want to get rid of customisation because it is expensive to maintain.

What is the percentage of customisation (i.e. not out-of-the-box) in your IT systems today?



Next, we asked respondents what the percentage of customisation in their IT systems will be in five years' time, and the largest proportion (26.25%) still believed that 50-70% of their systems would be customised. At the extremes, though, there was an increase in the proportion of those expecting more than 90% customisation (from 5.4% to 9.2%) while there was a small decrease in those expecting less than 10% customisation (from 6.9% to 6.1%).

This expectation of increased customisation perhaps suggests a lack of belief that standardised out-of-the-box systems can meet operators' complex business objectives, such as those for differentiated customer experience and support for new business models.

> "The idea that a best of breed approach is sometimes the most applicable, while at other times off-the shelf or pre-integrated systems are most suitable, continues to hold the majority of mindshare."

System integrators vs software vendors

Moving on from attitudes to customisation, we asked respondents whether systems integrators or software vendors are more influential in IT transformation projects. The vast majority (69.7%) stated that both are equally important, with their own defined roles. However, a significant proportion felt that software vendors are taking leading roles. 18% said that software vendors often take the lead now and 1.9% said software vendors have replaced systems integrators completely, suggesting perhaps that some operators are choosing systems from a smaller number of vendors and therefore need less integration. This may also indicate some operators' preference that the lead software vendor plays the role of systems integrator. At the other extreme, 10.3% of respondents said that systems integrators are king.

Full scale IT system replacement

Next, we asked respondents whether five years ago they saw full scale IT system replacement as a necessity for most telecoms operators. Our respondents were near-completely split on this topic, with 50.6% saying they foresaw full scale IT system replacement as a necessity for most operators while 49.4% said they did not.

Significantly, when we asked them whether they saw full scale IT system replacement as a necessity for most operators today, 66.5% of respondents said they did, while 33.5% said they did not. This demonstrates that the need for full scale IT system replacement is more widely recognised today than it was five years ago, although a significant proportion – about one third of respondents – continue to doubt the necessity of large scale transformation.

We then explored how respondents expect IT system replacement to happen. The majority (69.5%) said they saw this as a gradual evolution with piece by piece replacement of individual system components with best of breed components. 22.4% expect a greenfield replacement of the entire IT stack with a new pre-integrated system, while the remainder (8%) expect a greenfield replacement of the entire IT stack with best of breed components.

Preferred approach to data migration

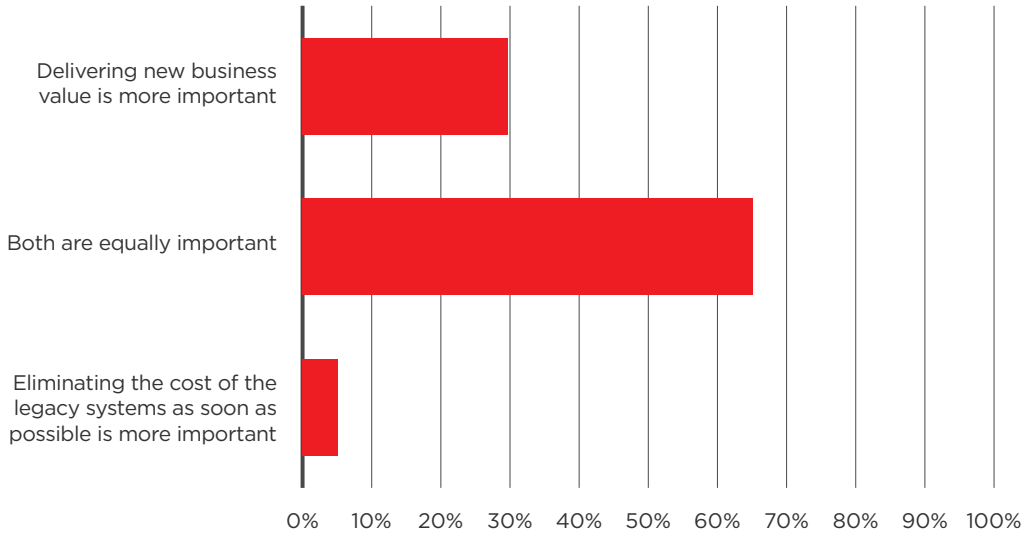
The majority of respondents to the next question also selected the evolutionary approach: What is your preferred approach to data migration? 54% of respondents said their preferred approach was segment-by-segment migration of customers from the old to the new system. 32.4% of respondents also planned to exercise caution, stating that they would start using the new system for greenfield customers and new business propositions in parallel with the legacy system before migrating existing customers on demand over a period of time.

It's likely that potential risks associated with mass migration and limited opportunities to test new systems at scale meant that the majority were cautious. However, 13.6% said their preferred approach was a big bang migration of the entire customer base in one go. Possibly these respondents were highly motivated to realise the potential cost savings from utilising new systems, which we explored in more detail next.

We asked respondents whether delivering new business value with a new IT system is a more important goal than saving costs by retiring legacy systems. The majority (65.1%) said they felt both are equally important goals while only 5.2% said that eliminating the cost of legacy systems as soon as possible is the most important goal (which perhaps demonstrates the unsustainable operational costs that a proportion of operators in the market suffer from).

However, the remainder of almost 30% was focused on finding new business value from new systems as opposed to eliminating the costs of old systems. They said delivering new business value is the most important goal for a new IT system, which suggests operators need to prioritise a greenfield approach, switching on the new system as fast as possible and retiring the legacy gradually, even though there will be a higher cost involved for running two systems at the same time.

Is delivering new business value with the new IT system a more important goal than saving costs by retiring the legacy systems?



Public cloud in mission critical telecoms IT

Next we turned to the issue of what type of platform to use for IT systems of the future. We asked respondents if they think the public cloud for mission critical or operational telecoms IT is a good idea. Responses were divided. 14.2% of respondents said that public cloud, in principle, is a good idea for all systems and 37.9% said that public cloud would be useful for the majority of systems, giving a total of 52.1% of respondents seeing wide applications in telecoms IT for public cloud.

However, 11.7% of respondents felt that public cloud is not suitable for any mission critical or operational telecoms IT and 36.2% could only see public cloud being suitable for a minority of systems. This chimes well with telecoms industry attitude that telecoms IT is a specialised environment that faces a series of security and resilience issues and therefore needs to continue to use telco-grade infrastructure.

We delved further into this issue with the next question by exploring when respondents expect to see greater utilisation of public cloud in mission critical telecoms IT. Again we found responses evenly split across the respondent base. 24.9% said that greater utilisation of public cloud is happening now while 24.5% expect this to happen within two years. The largest proportion of respondents expect greater utilisation to happen within five years, suggesting the operational flexibility and operational cost benefits of public cloud are understood but operators recognise migration will need to be carefully planned and consequently take time.

However, we also uncovered that 20.7% of respondents never expect to see greater utilisation of public cloud in mission critical telecoms IT. These respondents said that public cloud simply isn't suitable for mission critical systems.

> "The need for full scale IT system replacement is more widely recognised today than it was five years ago, although a significant proportion – about one third of respondents – continue to doubt the necessity of large scale transformation."

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