State of ResNet

2019 Report

**ResNet
Trends &
Practices Across
Higher Education**

CONTENTS

ResNet Introduction

The Association of College and University Housing Officers-International (ACUHO-I) is pleased to present research findings from the 2019 ACUHO-I State of ResNet Study.

In its eighth year, the Residential Networking (ResNet) study continues to track the current state of Residential Networking (ResNet) – trends, practices, policies and the development of standards among U.S. and International higher education institutions. The 2019 research findings, with 351 responding higher education administrators, bring light to the adversities, strategies, and solutions of providing high-performance networks in residence halls and campus-wide.

The State of ResNet report utilizes quantitative insights from three significant ResNet stakeholders: higher-education IT leaders, housing officers, and business officers. The outcome is a big picture view from leaders with unique, but collaborative, roles in residential networking. The findings cover the opportunities and challenges of technology and connectivity to support policies, budget, and student satisfaction.

"The swarm of everyday devices that connect to the web is changing everything. With student expectations for 'always on' Wi-Fi for any device anywhere, campus networks have become one of the most challenging initiatives for universities today. Our eighth annual ResNet study shows more schools rising to meet these expectations—providing students high-quality and reliable Wi-Fi not only in the classroom but also for online learning, entertainment, and in their living spaces. We believe this study will better prepare administrators to meet the connectivity needs of prospective and current students who judge the quality of their campus experience by its Wi-Fi."

– Mary M. DeNiro, CEO, ACUHO-I

Methodology

Since its initial launch, Forward Analytics has been contracted to perform industry research to support the State of ResNet Study. The primary purpose of the research is to gather quantifiable market intelligence to benefit higher education institutions and enhance the residential network for university and college students.

Forward Analytics works closely with ACUHO-I representatives to design a survey targeting higher education IT, housing and business officers and to administer online polling from February 2019 through April 2019. Over time, the survey instruments have remained mostly consistent but have some changes and additions to reflect the evolution of technology.

Significant Participation Rates

A total of 351 surveys were completed, presenting a 38% increase in completion rates since the initial study in 2012. The survey represents 200 universities or colleges (many institutions had multiple respondents of various job roles). With a sample (total) population of 1,700 U.S. higher education institutions, the response rate represents a statistical significance of +/-4.66% at the 95% confidence interval. With 351 institutional respondents, it can be said that if the survey were repeated 100 times, 95 in 100 times the research findings would vary at most +/- 4.66%. This level of sampling is deemed significant for supporting business decisions and strategic planning.
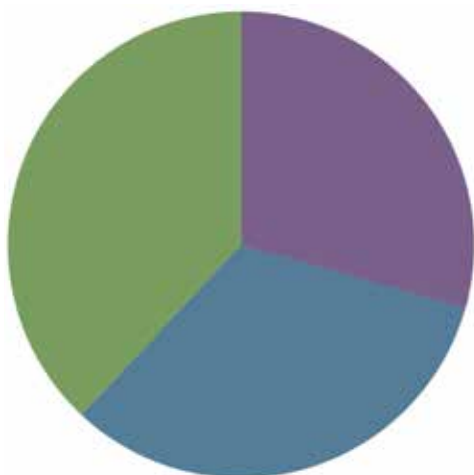
Size of Institutions

29.4% | **Small (fewer than 5,000 students)**

32.6% | **Medium (5,000 to 15,000 students)**

38.0% | **Large (15,000+ students)**

Number of On-Campus Students

A growing number of students are taking advantage of living on campus, enjoying the social, educational, and recreational opportunities. This has led to more schools increasing (and enhancing) their campus living spaces. New designs in residential living spaces foster a sense of community, utilize technology and blend academics to increase student satisfaction and retention. This year reports reveals that nearly half of the respondents have between 1,001– 5,000 on-campus students (an increase from 35% in 2016).

Number of Beds

28.2% | **Under 500**

21.4% | **501 to 1,000**

34.8% | **1,001 to 2,000**

14.2% | **2,001 to 5,000**

1.4% | **More than 5,000**
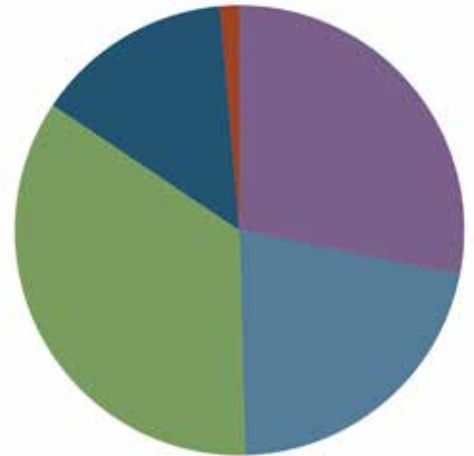
Job Responsibility

While sometimes job responsibilities overlap and there is often collaboration, State of ResNet survey respondents fell into three job responsibilities - IT, Business or Housing. Below is a percentage breakdown of those who reported their job responsibilities.

44.7% | **IT**

17.4%| **Business**

37.9% | **Housing**
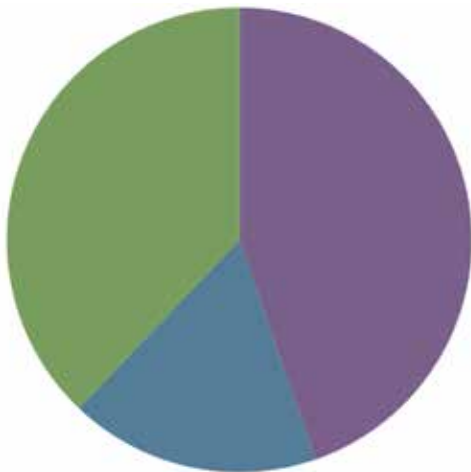
Governance:

Among the institutions represented in the survey, slightly more than half were public universities or colleges.

52.4% | **Public**

47.6% | **Private**

Executive Summary

Mobility on college and university campuses has skyrocketed in recent years. The average student brings five to seven internet-connected devices to campus. When you hear 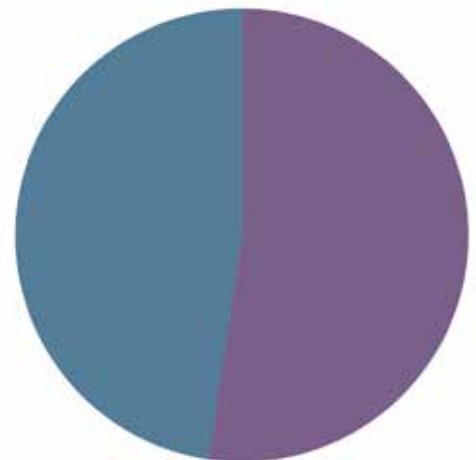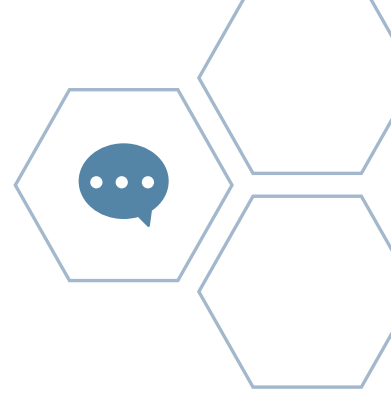that number, it seems unbelievable — that is until you start counting everything that connects —laptops, smartphones, wearables, entertainment gadgets, etc.

And prospective and current students have come to expect high-quality wireless access on every one of these devices, whether they are smartphones, tablets or notebooks. For higher education, this surge of mobile devices creates both opportunities and challenges. Increased access to technology engages students with their coursework and academic success.

Massive open online courses (MOOCs) and video, for example, are some of the best mediums for digital learning and teaching and can now be accessed on smartphones anytime, anywhere. However, the increased demands of mobility are wreaking havoc on the campus infrastructure and network. Schools are boosting their bandwidth and racing to expand wireless to all four corners of the campus. At the same time, funding complicates the matter. The cost savings that come with mobility are nothing compared with the expense of expanding the campus network. Schools struggle to fund these upgrades but are fully aware that they are necessary to remain competitive.

The 2019 State of ResNet Report details the current state of the ResNet and its components -internet, email, cable/video services, phone services, and support available to students living in on-campus residence halls. Incorporating the perspectives of IT, Business and Housing officers, the report details how universities and colleges are responding to the diverse and ever-evolving challenges for ResNet services. Within the report, we highlight the following topics: Bandwidth Management, Wireless Coverage and Capacity, Service and Support, Planning and Measurement, Funding and Technology Costs, and Outsourcing.

More Mobile Devices, More Capabilities, More Bandwidth Demands

- For the second year in a row, smartphones rank as the largest bandwidth consuming devices on college campuses.
- Netflix is seen as the biggest content threat to bandwidth capacity by 89% of schools.
- Mobile technology allows for innovative teaching and learning but puts a drain on campus bandwidth. Web-based rich content is ranked #2 in bandwidth-consuming applications – 80% of schools see it as jeopardizing bandwidth. Online learning tools increased by 7% since 2017.
- Streamed or downloaded video games (60%) and music (55%) also drain bandwidth, but they're part of everyday mobile culture.

## Meeting Bandwidth Demand for Competitive Advantage

- More than 95% of respondents believe a high performing ResNet is key to attracting and retaining on-campus residents.

- Three out of four schools now offer 1 Gbps or more ResNet bandwidth per student – a threefold increase from 25.5% in 2012 when the study began.

- Twenty-nine percent of campuses offer as much as 7 Gbps or more to accommodate student needs.

- Fewer schools are capping bandwidth – dropping from 32% in 2012 to 10% now. But three out of four schools utilized bandwidth management practices consistently throughout the years.

- More schools are relying on independent providers to successfully manage residential network bandwidth.

The Pressure is On for Campus-Wide Wireless

- Sixty-eight percent of business officers support expansive Wi-Fi coverage for the entire campus – an 11% increase from last year.

- Nearly three out of four schools offer wireless coverage at 81-100% of the whole campus.

- Eighty-four percent of schools offer robust Wi-Fi throughout 81-100% of their on-campus student areas – a 23% increase over the past five years.

- Outdoor wireless coverage near residential buildings continues to rise.

Widespread Wi-Fi But Limited Service and Support

- Seventy-two percent of colleges and universities allow an unlimited number of devices to connect to the residential network, yet few schools provide support for all technology on campus.

- While there's a rise in schools offering 24/7 support, there is also an increase in the number of schools with no live help desk.

- Modern devices and applications are seldom utilized for technology support services. Call centers, email and walk-in support are still the services "de jour."
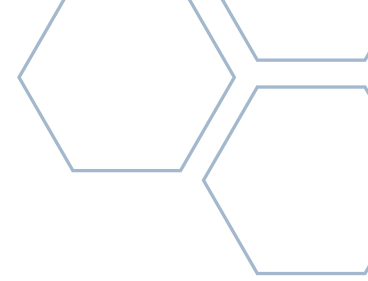
Wireless Anywhere, Anytime Demands Prompt Better Strategic Planning

- This year brings an increase in schools with a strategic plan for ResNet. More schools are also updating their strategic plans for ResNet *annually* or *biennially* – a 6% rise from last year.

- Strategic plans are becoming a collective vision with IT and housing officers meeting more frequently.

- But the connection between business and IT officers is lagging. Sixteen percent of business officers do not meet at all with their IT department.

- Housing and business officers have developing interests in diagnostics to support strategic planning. Housing officers want more information on cost and security, and business officers are more intrigued with performance.

- More business officers are satisfied with the diagnostic information available – a rise from 17% satisfaction in 2015 to 39% today.

Costs Expand with Wireless Connections

- Annual IT budgets over $2.5 million have nearly tripled in the past year to meet student expectations.

- Sixty-two percent of schools expect the cost of wireless network services to increase over the next two years, with 43% expecting a cost increase of 5% or more.

- Sixty-eight percent of business officers have growing concerns about Wi-Fi management and budgeting – a rise of 10% since 2017.

- Two out of three technology officers have concerns that the capital funding for network infrastructure will affect ResNet performance.

More Outsourcing, More than just ResNet

- More schools are outsourcing – 16% of schools outsource their ResNet services, a 6% increase from 2016.

- Nearly 7% of schools are now outsourcing their academic/administrative networks.

- Cable TV is the most outsourced service, with 61% currently outsourcing. IPTV outsourcing shows a dramatic increase – a jump to 30% this year, a 22% increase since 2016.

- Outsourcing IT help desk support is rising to improve the service and costs. Ten percent of surveyed institutions currently outsource help-desk services, and another 3% are considering outsourcing.

Bandwidth Management

Key Takeaways:

The modern digital classroom integrates technology to enhance the student experience. Mobile devices such as smartphones have become conduits for learning, and increasingly sophisticated and advantageous for higher education. At the same time, smartphones can be disruptive in the classroom and are often viewed as a significant threat to campus bandwidth consumption and the IT network.

With the upsurge in connected devices, and their insatiable appetite for bandwidth, universities must boost, manage and optimize bandwidth usage in order to maintain network efficiency and cost-effectiveness. Over the span of this tracking study, schools dedicating ResNet bandwidth at 1 Gbps or more have tripled to 74%. Twenty-nine percent offer as much as 7 Gbps or more to meet the student demand.

Three out of four schools implement in-house bandwidth management practices, while some rely on vendors, or third parties, to manage bandwidth.

Data analysis shows that schools that outsource Resnet are less likely to require bandwidth management practices versus schools that in-house their network.

Snapshot of Bandwidth Management

Digitization has driven a shift in behavior, with expectations rising and changing more frequently. These dramatic changes are most apparent on college campuses. The wide variety of methods of obtaining digital access and information enables students to find out what they want to know more quickly and independently than ever before.

The digital classroom is the new paradigm in teaching and learning in higher education, with tablets, laptops, and smartphones becoming staples of digital education. Mobile devices expand the boundaries of the classroom and encourage a stronger sense of community, both inside and outside. Creating an active digital learning environment is not just about offering students convenience and familiarity. New digital tools and applications enrich instructional approaches, disciplines and learning goals. However, while digital technology enhances the student's education and experiences, the IT infrastructure at higher education institutions is in distress.

Immersive technology, augmented analytics, smart spaces, and Internet of Things technologies are some of 2019's ed-tech trends. As learning techniques become increasingly sophisticated, the traffic load increases and becomes more consuming. However, keeping up with these trends could give universities the cutting edge for attracting and retaining stu-

dents. Consequently, competitive universities must back the technology revolution by providing reliable IT networks in residence halls and other non-academic areas. Supporting research shows that 95% of housing and technology officers agree that a high-performance ResNet is vital for attracting and retaining students.

Since the onset of this study, the number of schools dedicating bandwidth at 1 Gbps or more to ResNet has nearly tripled from 25% in 2012 to 74% today. Twenty-nine percent of colleges and universities offer 7 Gbps or more.

Bandwidth Dedicated to ResNet

Category	2019	2018	2017	2016	2014	2012
1 Gbps or more	73.6%	71.9%	70.4%	64.8%	44.8%	25.5%
501 – 999 Mbps	6.6%	8.4%	14.1%	13.2%	12.9%	14.9%
100-500 Mbps	14.1%	11.8%	9.4%	15.9%	35.6%	30.7%
99 Mbps or less	5.7%	7.9%	6.0%	6.0%	6.7%	23.9%
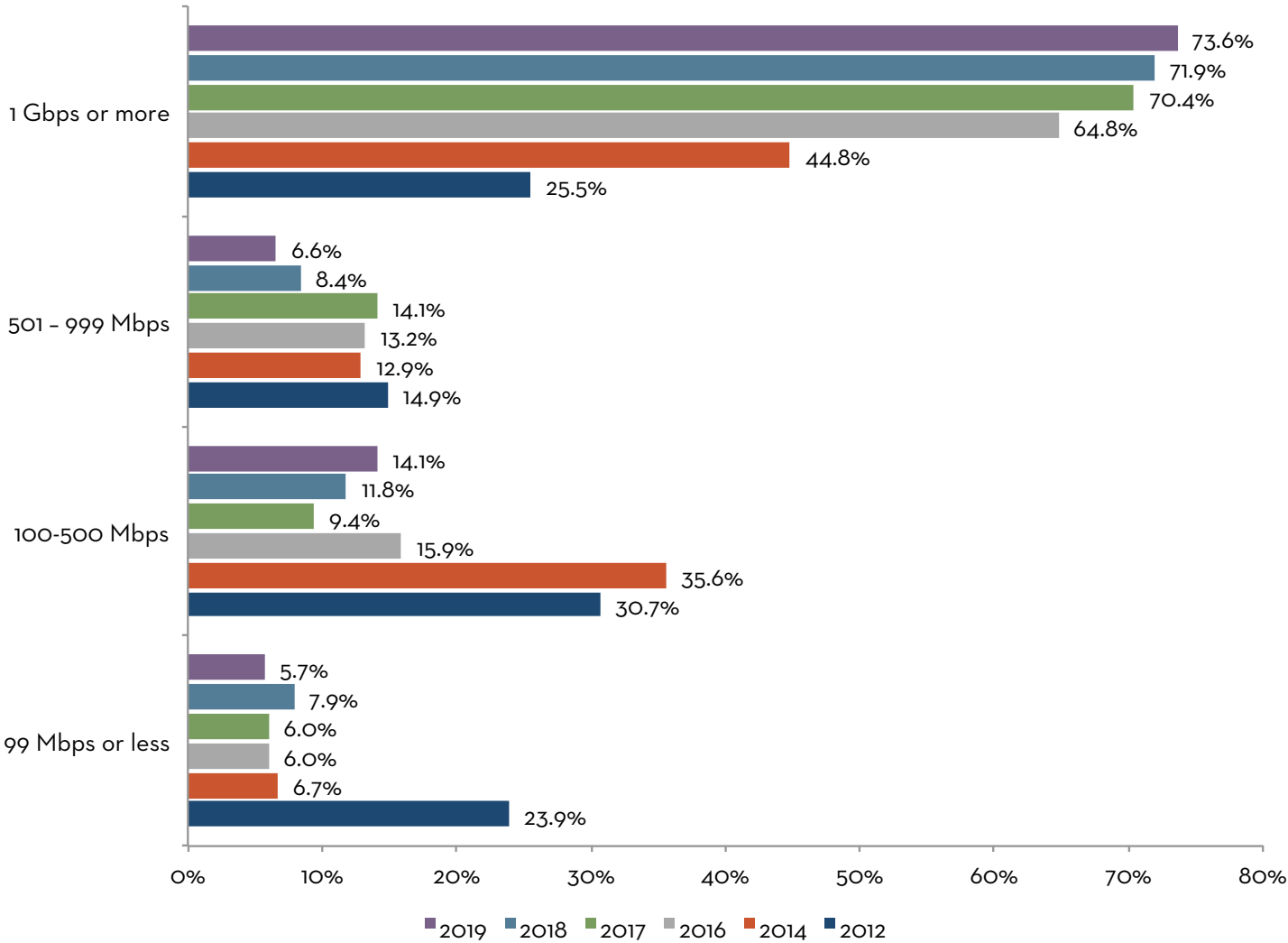
As schools bolster their residential networks with more bandwidth, the survey tool changed to take a more precise measure of what campuses offer. The past four years presents an increase of 8 percent of schools offering 7 Gbps or more bandwidth dedicated to ResNet.

Bandwidth Over 1 GBps Dedicated to ResNet

7 Gbps or more
- 29.2%
- 30.5%
- 26.8%
- 20.9%

5-6 Gbps
- 5.7%
- 5.9%
- 4.7%
- 8.2%

3-4 Gbps
- 11.3%
- 5.9%
- 14.1%
- 8.8%

1-2 Gbps
- 27.4%
- 29.6%
- 24.8%
- 26.9%

Legend: ■ 2019 ■ 2018 ■ 2017 ■ 2016
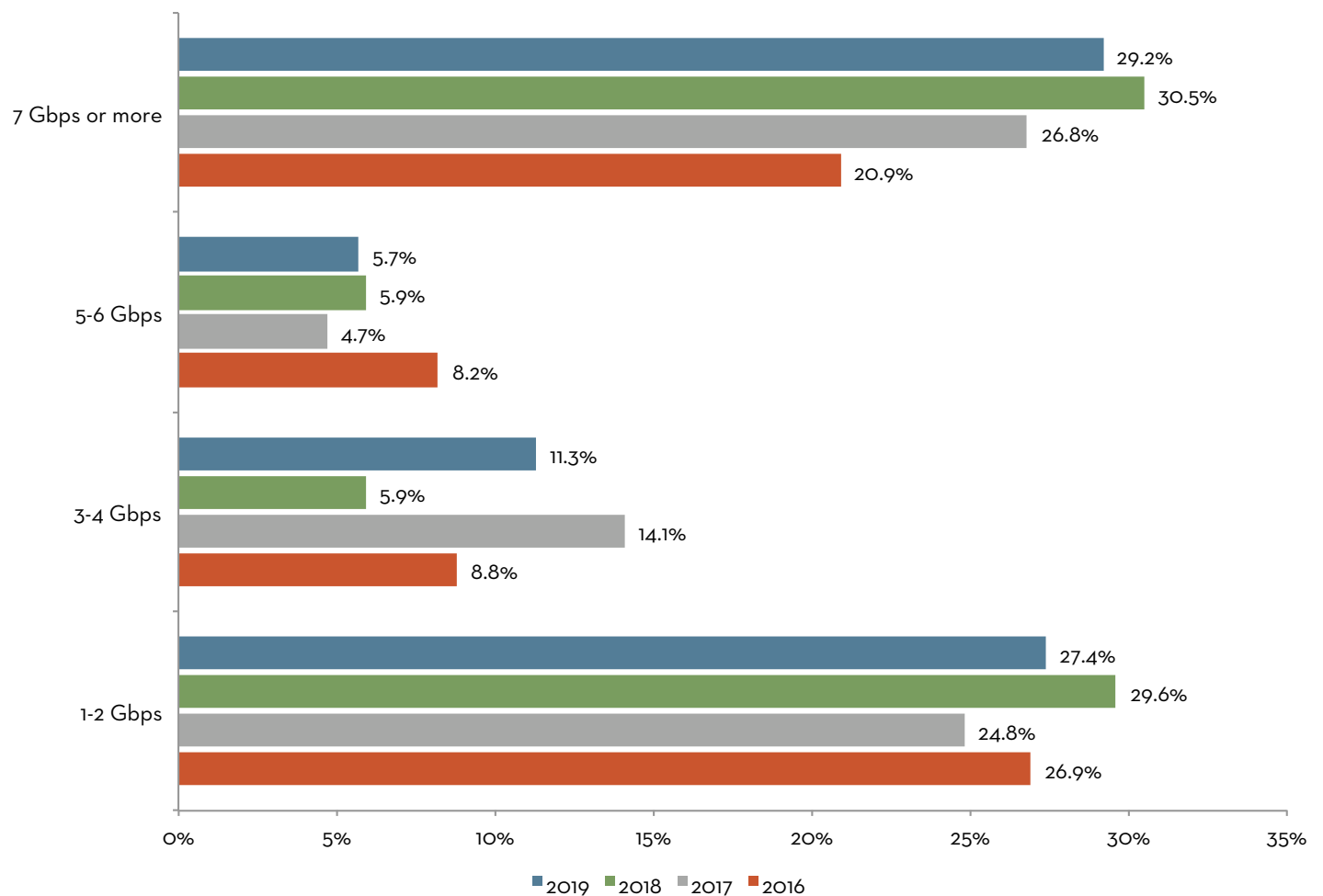
Future Bandwidth Consumers

While "on the go" via mobile devices, college students today have unprecedented access to digital information. Ubiquitous and voracious smartphones topped the list as the biggest threat for bandwidth consumption. As expected, students use smartphones for streaming entertainment, such as video and games. Students are also captivated with several different applications and platforms on their smartphones that are integral to the learning process. Today's educators are also adapting more engaging modes of teaching and learning through collaborative and video-based learning.

This year, desktops and laptop computers cause less concern but still rank number two among high bandwidth consuming devices. Gaming devices remain consistent with slightly more than half of colleges identifying them as so-called bandwidth vampires. Colleges have growing concerns about the latest technologies and their drain on bandwidth. Wearable devices (educational, fitness and medical) all increased by 3% or more. Added this year, voice assistants (i.e., Google Home, Amazon Echo) are perceived as overly consuming by 13% of higher education institutions.

Largest Bandwidth-Consuming Devices	2013	2014	2015	2016	2017	2018	2019
Tablets (iPad, Android)	83.5%	73.4%	67.9%	57.7%	54.2%	55.2%	48.2%
Desktop and laptop computers	75.0%	69.3%	76.5%	58.6%	62.3%	64.6%	59.2%
Video systems (DVD/Blu-Ray Players, Apple TV, Roku, Sling)	63.6%	49.3%	53.7%	48.9%	50.0%	53.6%	47.3%
Smartphones (iPhone, Android)	63.2%	64.2%	66.8%	55.2%	61.8%	72.6%	72.8%
Game boxes (Xbox, PlayStation, Nintendo)	60.7%	46.7%	52.2%	41.9%	48.8%	53.5%	53.1%
Smart TVs	51.7%	37.2%	38.8%	36.6%	47.6%	58.9%	46.9%
e-Book Readers (Kindle, Nook)	27.8%	13.0%	9.4%	7.4%	27.3%	3.0%	9.3%
Wireless Printers	14.1%	5.8%	8.7%	7.8%	28.8%	12.9%	9.0%
Wearable educational technology (Google Glass, Gear VR, smart watches)	-	-	-	-	29.1%	7.5%	10.2%
Wearable fitness tracker (Fitbit, Nike)	-	-	-	-	27.1%	6.0%	9.4%
Wearable medical electronic devices	-	-	-	-	27.5%	3.0%	5.7%
Remote control vehicles/Smart vehicles (Drones, scooters, cars)	-	-	-	-	30.4%	4.6%	7.6%
Voice Assistants (Google Home, Amazon Echo, etc.	-	-	-	-	-	-	13.3%

Presently, 72% of colleges and universities allow students to connect an unlimited number of devices to the residential network. As the breadth of connected devices on-campus expands, schools are forced to increase their bandwidth dedicated to ResNet.

It is also important to note which data is using the most bandwidth. Video streaming sites like Netflix and YouTube use significant bandwidth, leaving the university to incur costs for recreational viewing. Video games (60%) and music (55%) also drain bandwidth.

Increasingly, students expect courses and materials to be accessible on their mobile devices just as they would their laptops. Web-based rich content (such as videos) jeopardizes bandwidth consumption – up to 80% this year. Online learning tools increased by 7% since 2017.
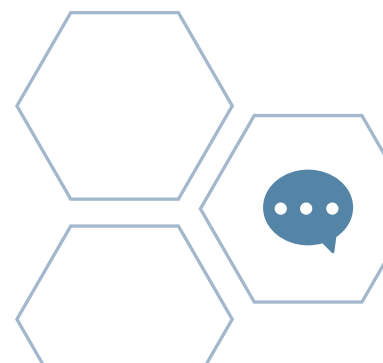
Largest Bandwidth Consumers By Application	2017	2018	2019
TV and video consumption (Netflix)	87.7%	88.1%	89.3%
Web-based rich content (such as video)	78.2%	76.0%	80.2%
Music and audio (internet radio, Pandora)	61.3%	52.6%	55.4%
Video gaming	51.7%	58.1%	59.8%
Cloud content (Spotify, Apples iCloud, etc.)	51.1%	49.5%	40.9%
Other social media	35.6%	36.9%	33.0%
Online learning tools	30.4%	32.9%	37.4%
Personal video and photos (Flickr)	28.7%	34.7%	28.0%
Interactive digital textbooks	13.3%	14.1%	13.3%
e-books	8.8%	9.5%	8.2%

Optimizing Bandwidth

By understanding which data is using the most bandwidth, schools can be proactive with policies and network management practices to ensure students have access to what they need for education as well as entertainment.

Three out of four schools presently utilize bandwidth management practices. While this number has remained consistent over the past year, 2019 presents new approaches to bandwidth control. These tactics, some respondents shared, include comprehensive QoS policies to ensure traffic prioritization, throttling of BitTorrent traffic, dedicating 10G connection for IPTV, and limiting campus guest usage.

More schools are relying on a vendor, or third-party, to manage residential network bandwidth. The research shows colleges that outsource ResNet or Internet are less likely to manage bandwidth in-house (the figure drops to 38% for those that outsource).

The number of schools that cap bandwidth declined significantly throughout the years. In 2012, 32% of institutions employed individual bandwidth quotas. Today, only 10% cap bandwidth.

Bandwidth-Management Practices

	2013	2014	2015	2016	2017	2018	2019
Shaping and limiting bandwidth by protocol	72.4%	66.7%	77.3%	46.2%	30.7%	41.0%	30.7%
Blocking activities such as p2p sharing, music downloading, etc.	N/A	52.0%	68.1%	40.1%	33.9%	44.4%	38.6%
Shaping network-wide throughput available to streaming video	22.9%	18.6%	25.9%	20.3%	11.5%	10.7%	10.5%
Implementation of cache servers	22.9%	21.1%	25.9%	25.4%	24.5%	19.5%	20.2%
Providing minimum guaranteed service levels by user	12.9%	15.2%	20.8%	10.2%	9.9%	11.7%	14.0%

Wireless Coverage and Capacity
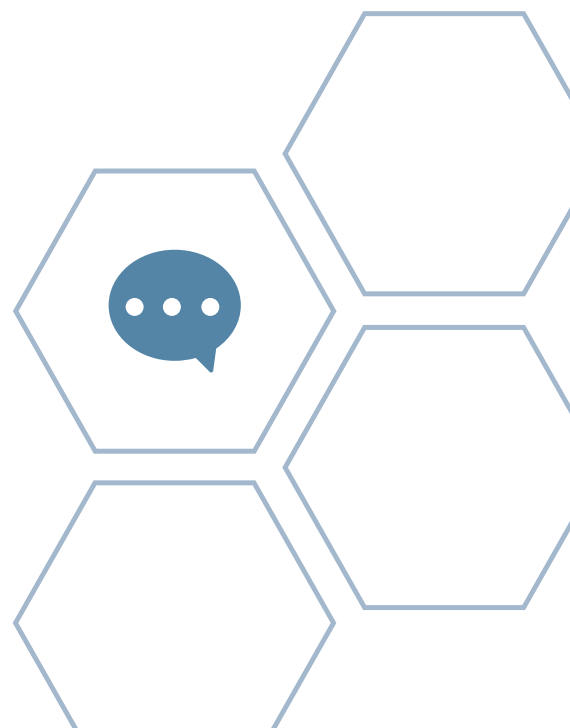
Key Takeaways:

- Nearly three-fourths of schools today offer comprehensive Wi-Fi throughout 81-100% of the whole campus – a 17% jump over the past three years. Ninety-eight percent of business officers believe that superior Wi-Fi connectivity and services is critical to upholding their university's mission.

- Robust wireless service in outdoor areas near residential space is increasing, yet coverage in academic spaces, computer labs, and common areas had a small decline over the past three years

- Regardless of the surge in wireless devices and the resulting increase in Wi-Fi coverage, Ethernet ports are still needed to support the massive data transfer needed for learning and entertainment. Eighty-three percent of schools include ethernet ports in new construction, and 55% will keep them in existing residential buildings.

- IPTV is on the rise and presently 14% of schools transitioned from traditional cable for the newer video solution. Another 72% are largely considering the switch.

Snapshot of Current Academic Environment & Wireless Coverage

In today's competitive academic environment, students look for fast, secure wireless connectivity when deciding on their college of choice. The smartphone explosion, the evolution of technologies for learning/teaching, and an exponential increase in video consumption have driven schools to double their bandwidth and upgrade their Wi-Fi capacity over the past decade. Now expectations are high for schools to extend the Wi-Fi coverage to every corner of campus.

Online degree programs and classes accessed through desktops or laptops were the first signs of disruptive technology when schools implemented online courses to differentiate their colleges. Schools today leverage technology within the classroom *and beyond* as current pedagogy embraces new devices and their applications. Students rely on mobile devices for online classes just as professors are creating an online culture to support mobile devices.

At its simplest, teachers and students are communicating more with mobile devices. And course content is converted to PDF files so it can be easily read or accessed on a mobile device. At a higher level, learning initiatives continue to move towards online testing platforms, video lectures, video conferencing, and other multimedia are delivered wirelessly. Adaptive learning technologies break ground as they monitor student progress and use data and artificial intelligence to modify teaching methods based on that data.

If a Wi-Fi connection cuts out or experiences weak spots and dead zones, students and faculty will not have access to the apps and broadband services they require for education, as well as convenience and quality of life. Ninety-eight percent of business officers believe that superior Wi-Fi connectivity and services is critical to upholding their university's mission. Moreover, 68% of business officer support expansive Wi-Fi access or coverage for the entire campus – an 11% increase from last year. Twenty percent of Business Officer believes Wi-Fi coverage should be in response to students/parents/faculty/staff demands.

There has been a sharp climb in the number of colleges and universities offering campus-wide wireless coverage. Students now demand a seamless wireless experience in Wi-Fi connection in stadiums, auditoriums and outside and, in response, 73.3% of schools presently offer wireless coverage at 81-100% of the whole campus.
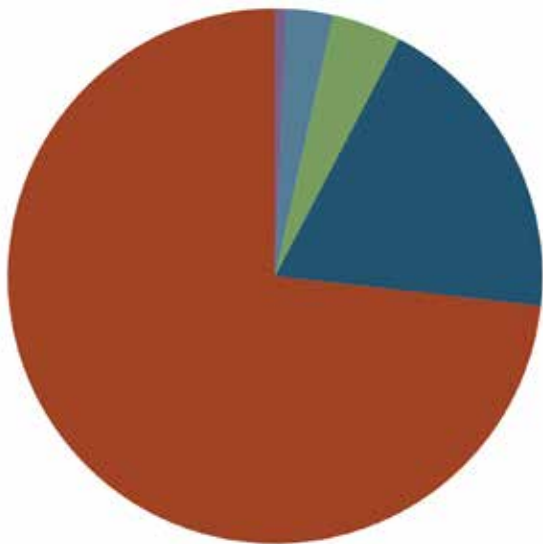
Percentage of Whole Campus with Comprehensive Wireless Coverage

0.7% | **0-20%**

2.8% | **21-40%**

4.2% | **41-60%**

19.1% | **61-80%**

73.2% | **81-100%**

Coverage and capacity are the basic principles of a superior Wi-Fi network, but not all schools can devote the capital or tech support for a campus-wide wireless overhaul. Some schools focus on density and capacity and provide robust Wi-Fi in high traffic areas. Eighty-four percent of institutions offer strong wireless connection throughout 81-100% of their on-campus student areas – a 23% increase over the past five years.

Percentage of On-Campus Student Areas with Strong Wireless Connection

81-100%
- 84.2%
- 80.3%
- 76.7%
- 82.8%
- 61.2%

61-80%
- 12.9%
- 15.7%
- 16.1%
- 12.5%
- 21.8%

41-60%
- 0.4%
- 2.9%
- 5.8%
- 2.6%
- 7.1%

21-40%
- 2.1%
- 2.5%
- 0.4%
- 1.0%
- 4.1%

0-20%
- 0.4%
- 0.0%
- 0.9%
- 1.0%
- 1.5%

Legend: ■ 2019 ■ 2018 ■ 2017 ■ 2016 ■ 2015
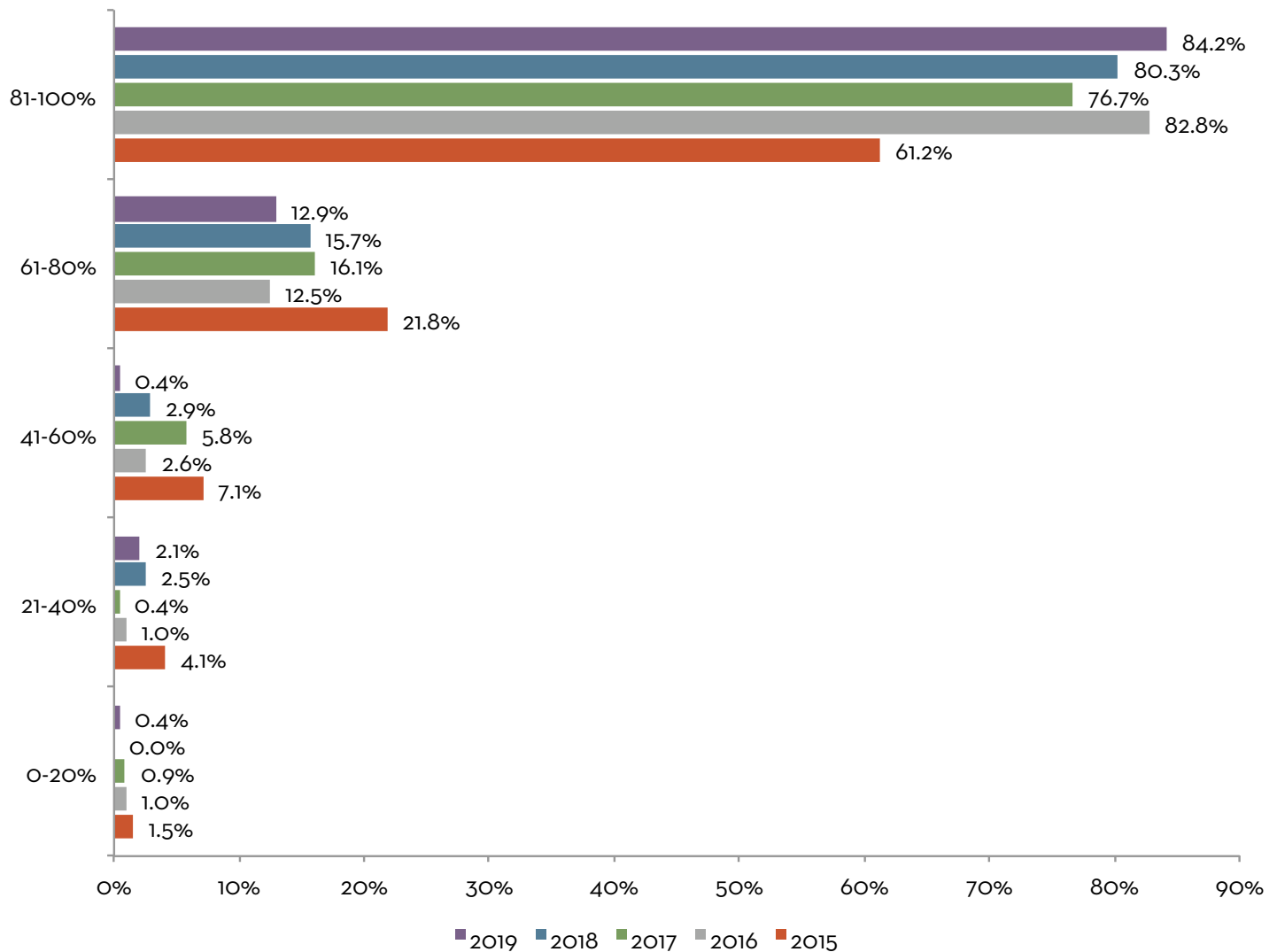
While campus-wide wireless coverage is becoming more popular, particularly in outside areas, coverage in some residential spaces seems to be falling behind. Academic spaces, computer labs, and common areas in residential buildings all show a small drop in robust wireless coverage over the past three years.

Percentage of Campuses offering Robust Wireless Coverage in 81-100% of Residential Areas

	2014	2015	2016	2017	2018	2019
Academic spaces in residences, including classrooms and study areas	73.0%	71.4%	86.1%	87.3%	84.3%	83.3%
Residential Computer Labs	73.0%	72.1%	81.0%	87.9%	87.8%	85.5%
Administrative areas (front desks, area offices, residential staff offices, etc.)	71.2%	66.9%	82.9%	85.5%	81.2%	85.1%
Common areas and community spaces	69.9%	66.1%	80.2%	80.2%	78.2%	77.4%
Dining facilities	69.3%	66.9%	81.4%	80.8%	79.2%	81.1%
Residential rooms, suites, or apartments	59.0%	58.7%	87.8%	82.2%	82.6%	85.5%
Outside areas adjacent to residential spaces (courtyards, parks, breezeways, etc.)	19.6%	12.1%	19.3%	11.9%	20.5%	25.0%

Cellular Reception

Most colleges rely upon a traditional cell tower on or adjacent to their campus to provide cell services to their students, facilities and guests. However, many college campuses are expansive and covered with large structures, older buildings, underground facilities, and even newer, environmentally-friendly buildings that obstruct radio frequency waves. In addition, thousands of students simultaneously use a tremendous amount of data and applications that need an above average amount of cellular and wireless connectivity. In order to get robust, reliable Wi-Fi, many schools need a boost.

Presently, 45% of schools are considering an array of technologies that can be used to enhance connection and expand network capacity. Digital antenna system (DAS) is currently deployed by 8.5% of schools. Another 23.6% of schools are considering in-building DAS; 18.1% are considering outdoor DAS. Nearly 20% of schools are considering outdoor cellular sites/towers.

Presently, fewer schools are considering cellular augmentation compared to five years ago. Most schools today (66%) choose not to augment their cellular reception because they believe its performance is satisfactory. Forty-one percent have the perception that the carrier is responsible for providing satisfactory cellular coverage.

The demand for high-speed cellular and wireless connectivity has also increased the needs for schools to deliver faster, more reliable data to keep up with their network traffic.

Switches and Hubs

Wi-Fi infrastructure and networks alone are not always sufficient enough to meet the needs of today's always connected student. Consequently, 36% of schools allow campus residents to install personal network support to enhance their Wi-Fi experience. Most common are switches and hubs where nearly one in four schools permits their use. While routers and wireless routers were on the decline, the past year presents a small comeback.

Personal Network Support

Chart: Personal Network Support (legend: 2015, 2016, 2017, 2018, 2019)

- **Servers:** 2015: 9%, 2016: 13%, 2017: 9%, 2018: 14%, 2019: 19%
- **Switches:** 2015: 21%, 2016: 23%, 2017: 18%, 2018: 28%, 2019: 26%
- **Hubs:** 2015: 23%, 2016: 11%, 2017: 15%, 2018: 22%, 2019: 23%
- **Wireless Routers:** 2015: 9%, 2016: 6%, 2017: 7%, 2018: 8%, 2019: 12%
- **Routers:** 2015: 10%, 2016: 8%, 2017: 10%, 2018: 12%, 2019: 17%
- **None of the above:** 2015: 59%, 2016: 61%, 2017: 41%, 2018: 68%, 2019: 64%
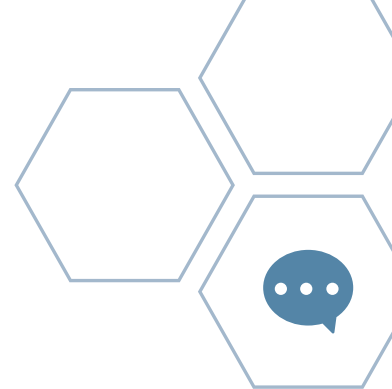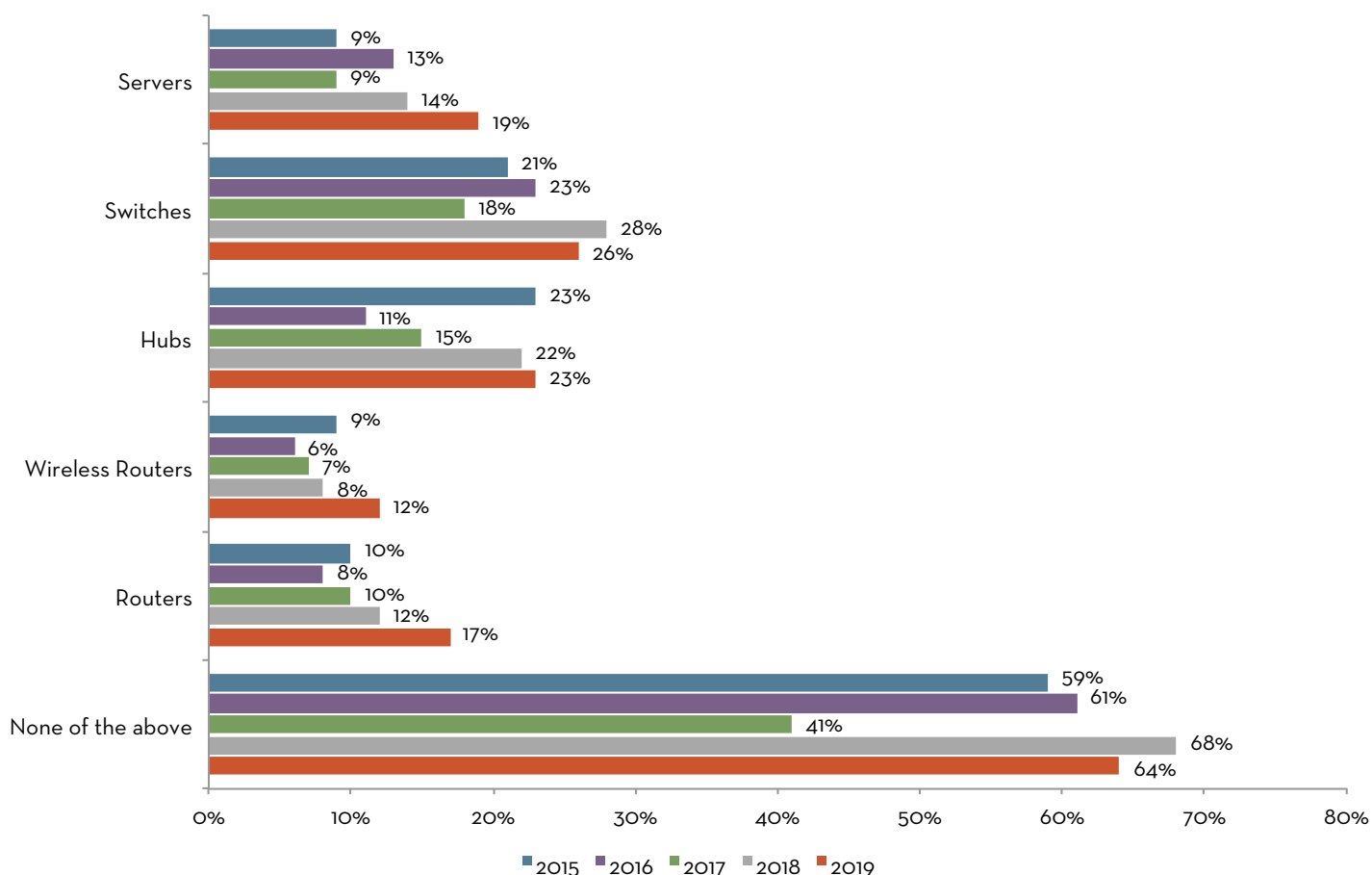
Wired Ethernet Ports

Wireless devices weigh down the campus network, and the development of education technologies will likely add to the problem. As video and big data consumption continue to rise, it can be beneficial to the school (and students) to offer wired ethernet access ports. A wired device can provide speedier, seamless connection and a more satisfied student. As such, 55% of schools are keeping ethernet access points in existing residential buildings. And, 83% of schools with new construction will include ethernet in the network design. Nearly half will provide one port per student; almost one-half will offer one port per residence.

In contrast, the number of schools switching to wireless only in new construction has nearly doubled – yet still stays as low as 15%. Ten percent of schools have already removed ethernet in existing residential and another 12.4% plan to eliminate it.

IPTV

IPTV is rising quickly in response to student demand for video on smartphones, tables, desktop PCs, internet-connected television sets, and similar devices. Nearly one in three schools provides IPTV with their cable television services as an on-campus video solution. Fourteen percent have transitioned from traditional cable to IPTV, IP video, etc. Another 72% of schools are giving *much or some consideration* to the switch.

Transitioning from Cable TV to IPTV

Year	No consideration	Some consideration	Much consideration	Made the change to IPTV
2019	14%	38%	35%	14%
2018	8%	49%	28%	16%
2017	18%	50%	24%	9%
2016	16%	49%	27%	9%
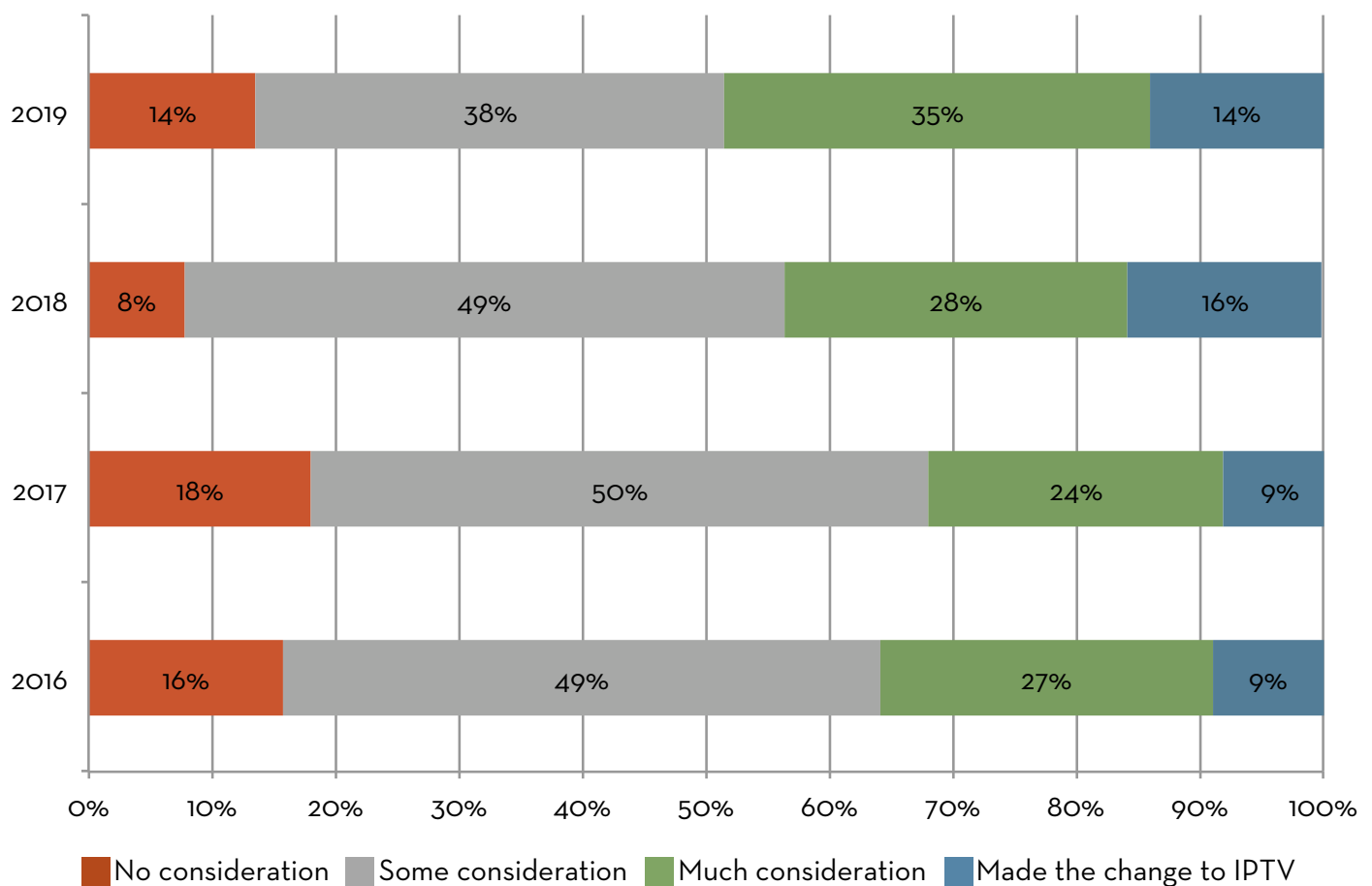
Mobile devices are emerging as a key area for IPTV growth as users can now watch video on their smartphones and tablets at almost any campus location. Subsequently, the network is slowed down or clogged as more people try to access content simultaneously. To support the amount of bandwidth required for extraordinary video content delivery, schools will benefit from putting in place technology strategic plans to scale their Wi-Fi networks as demand inevitably rises.

Key Takeaways:

- Communication evolves with technology but that's not the case with student network support. Old-school support methods prevail, with on-site/walk-in support offered by 80% of universities, and phone and email both offered at 92% of schools. The number of schools offering support through text or Facebook has remained consistently low.

- Central IT (Networking, Security, etc.) plays the lead role in maintaining infrastructure and end-user support for the ResNet. Forty-seven percent of schools do not have any full-time IT staff in their housing/residence life department.

- More than 95% of all respondents believe a high performing ResNet is key to attracting and retaining on-campus residents. Sixty-three percent of schools rely on their housing department to measure ResNet satisfaction. However, 87.3% of housing officers devote less than 20% of their time to ResNet.

- Ten percent of institutions are outsourcing help desk services, while another 3% are strongly considering it. Schools that outsource ResNet more often offer 24/7student support versus in-house solutions.

Snapshot of Support Services

Multiple departments and administrators play a role in supporting residential networks, from infrastructure to operations of the network, support, and strategy. For the past eight years, Central IT (Networking, Security, etc.) has been *primarily* responsible for maintaining the physical infrastructure of the internet network for on-campus housing facilities for the majority of universities and colleges. Central IT has also been responsible for supporting end users (residents, staff, faculty, guests, etc.), though 21% of higher education institutions rely on Student Affairs.

Independent providers not affiliated with universities have grown in favor, with schools relying on them for upgrading network infrastructure, end-user support, faster deployment and to establish more efficiencies. Over the past two years, the rate of schools outsourcing these services has almost doubled, growing from 6% to 10% in both end-user support and infrastructure maintenance.

A solid 95.4% of business, housing and technology officers believe a high performing ResNet (coverage and capacity) is of paramount importance in attracting and retaining on-campus students. Sixty-eight percent of schools measure student satisfaction with ResNet services (a 9% increase from last year). It is usually the responsibility of Housing and Residence Life to manage satisfaction with on-campus living. And, most

often (62.7%), it is the housing department that measures ResNet satisfaction, while 22.9% of institutions rely on IT. But, Housing Officers have few responsibilities over the delivery of ResNet. In fact, 87% of Housing Officers devote less than 20% of their time to ResNet.

It seems that at most schools, Central IT runs the show, as 67% of housing departments receive their IT support from the Central IT department, and less than one in four rely on the IT department within Housing & Residence Life. Forty-seven percent of housing departments have no full-time staff members working within their housing/residence life IT department. As housing officers face higher expectations to increase satisfaction and fill beds, they will benefit from deepening their role in the delivery of ResNet services as these services increasingly become the make-or-break for on-campus residents.

Options for Support

The widespread use of mobile devices means that students expect high service levels on campus as they would anywhere else, or the school's reputation can be at risk. Not only should the IT infrastructure be equipped to meet this demand, but students expect the university to facilitate their tech support needs too. In this age of digital transformation, efficiency and self-service are pertinent to satisfaction.

Nothing frustrates a student more than poor IT support in their time of need. When students have questions or problems, their first point of contact is the IT technology services help desk. Unfortunately, many schools are lacking fully equipped help desk support knowledge, solutions, and staff; their budgets simply do not allow the cost. Moreover, we find 14% schools that do not have help desk (live support) at all – a 6% rise in the past five years.

IT help desk services and support are being outsourced more by higher education institutions in order to improve the process, service and cost. Ten percent of surveyed institutions currently outsource help-desk services, and another 3% are considering outsourcing.

Another reason to outsource IT help desk is to provide more flexible hours. The below graph shows a steady increase in help desk availability throughout the years. Nearly one in four schools offer ceaseless support services to meet the 24/7 lifestyle of students - an 8% increase since 2015. In all, 61% of schools provide more than 9-to-5 live help desk support. Seventy percent of schools that outsource ResNet provide 24/7 support compared to 15% of schools with in-house networks.

Availability of ResNet Help Desk

Year	Do not have a Help Desk	1-30 hrs	31-40 hrs	41-60 hrs2	more than 60, not 24 hrs	24/7
2019	14%	6%	19%	18%	21%	22%
2018	12%	5%	21%	23%	22%	17%
2017	15%	2%	19%	28%	21%	14%
2016	7%	2%	18%	26%	34%	14%
2015	8%	2%	17%	32%	15%	15%

Legend: ■ Do not have a Help Desk ■ 1-30 hrs ■ 31-40 hrs ■ 41-60 hrs2 ■ more than 60, not 24 hrs ■ 24/7
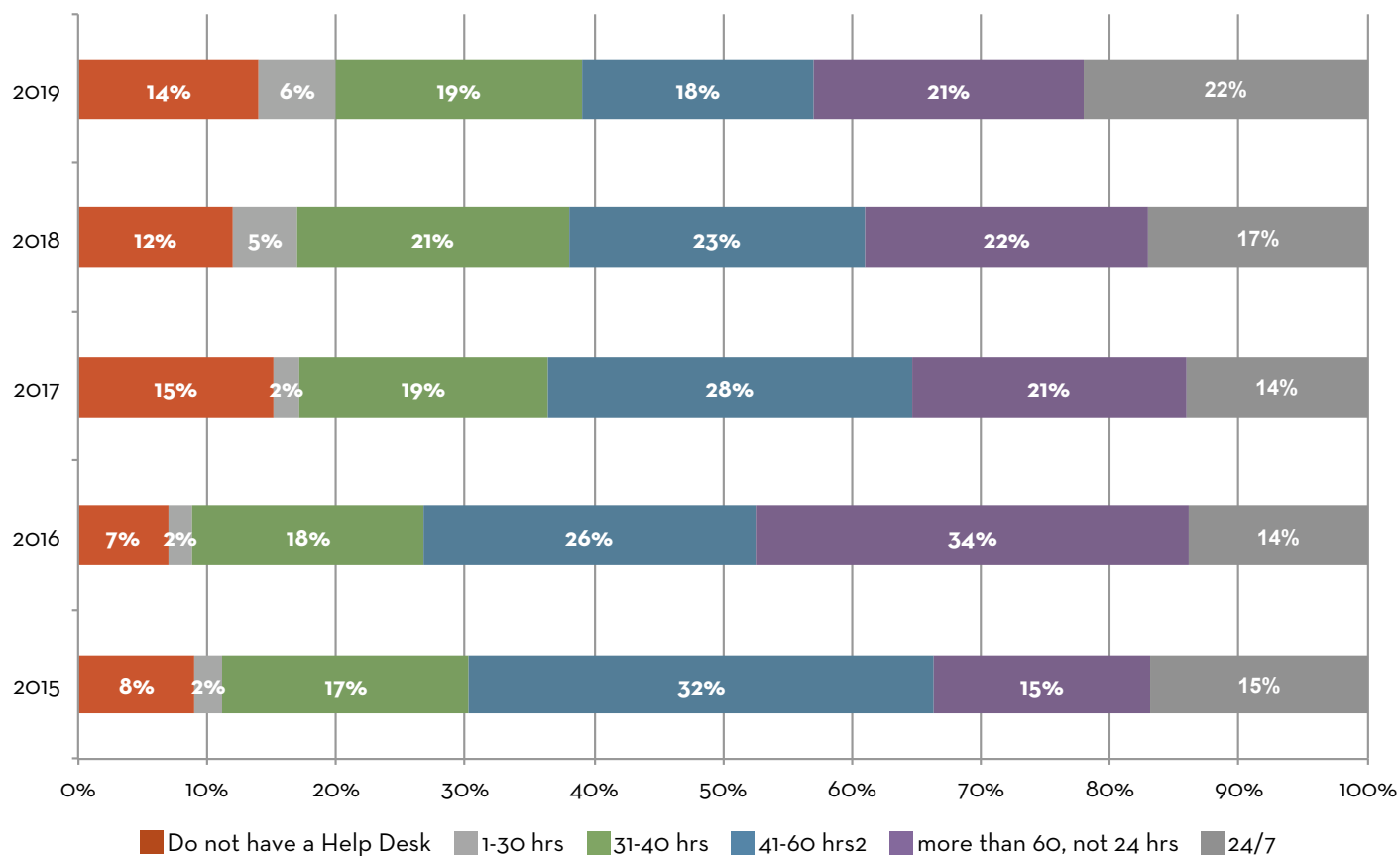
For all the conveniences that technology brings, helpdesk and network support has been slow to utilize communication modes popular with today's students. Most schools offer email (92%) and call-center (92%) support. However, few institutions utilize text messaging (14.7%) or Facebook (19%) for troubleshooting. Almost 3 out of 4 schools utilize web/wiki/online FAQ for self-serve support options.
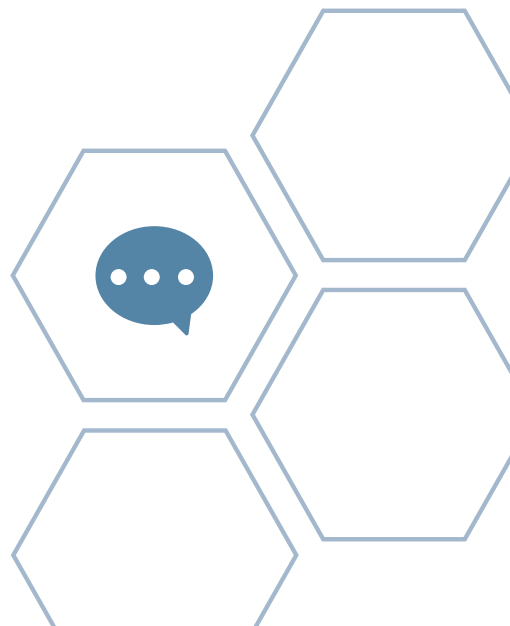
Network Support Options

Support Option	2019	2018	2017	2016	2015
on-site/walk-in	80%	80%	88%	91%	86%
Facebook/twitter/blogs	19%	17%	26%	37%	25%
web/wiki/online FAQ	75%	67%	78%	77%	78%
email	92%	86%	91%	91%	88%
live chat	27%	20%	27%	28%	32%
text message	15%	13%	14%	15%	17%
call center	92%	90%	95%	92%	91%

■ 2019 ■ 2018 ■ 2017 ■ 2016 ■ 2015

Planning and Measurement
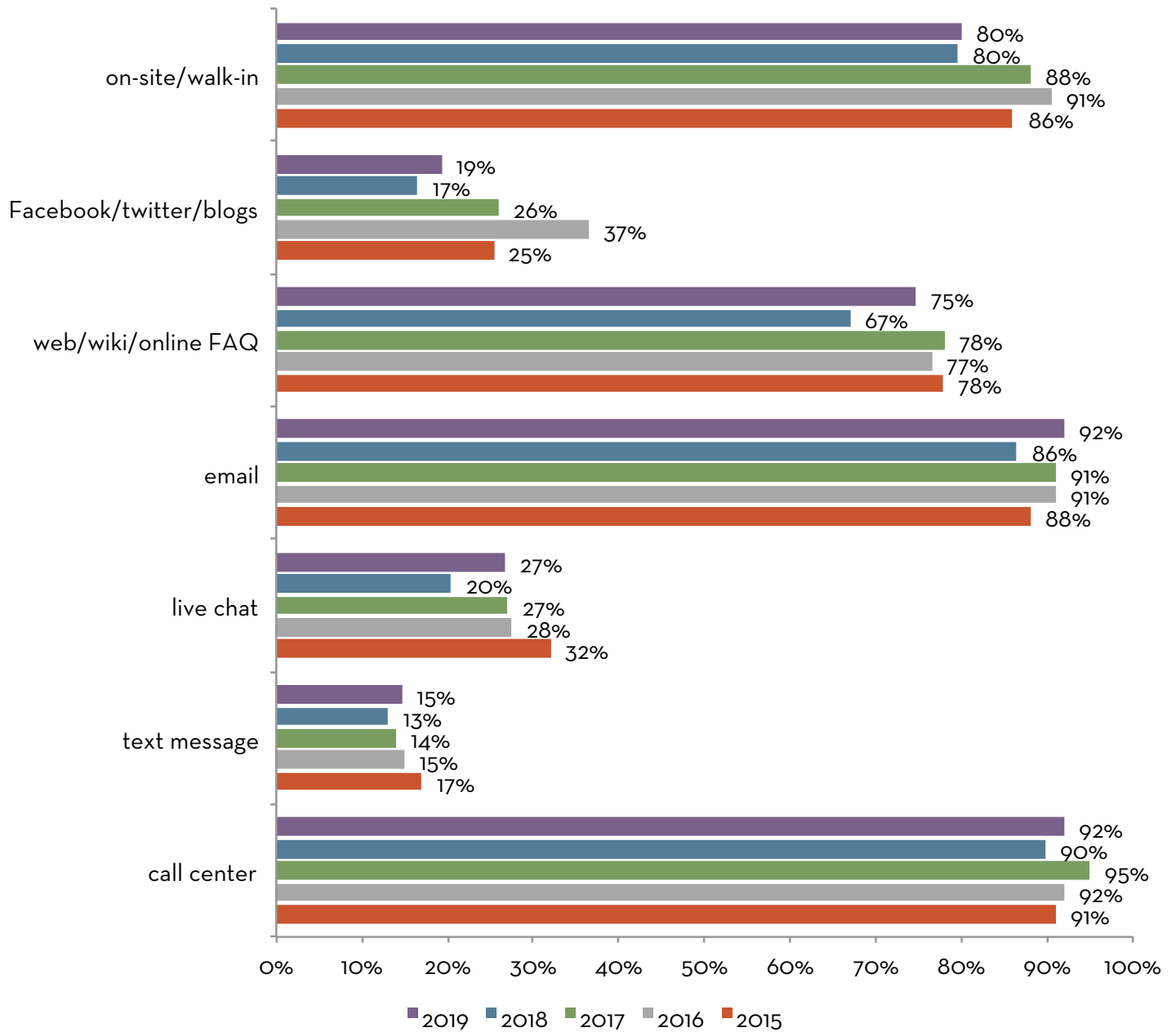
Key Takeaways:

- The need for ongoing strategic planning and communications is growing in importance as ResNet becomes a competitive factor among colleges and universities. More schools are updating their ResNet strategic plans *annually* – an increase of 8% since 2015. IT and housing officers are meeting more frequently, but communication with business officers has dropped.

- Today, business officers have more diagnostic information available for strategic planning and decision making. Cost-to-performance is the area that requires added information. Business officers rank reliability, performance (speed), and security as top drivers of IT and Network Services with cost ranking lower.

- Housing officers' satisfaction with ResNet services has remained relatively consistent through the years, though this year shows a slight decrease in satisfaction across the board, with one exception (reliability ratings stayed the same). Housing officers also reported a growing need for cost-to-performance and security breach information.

- While benchmarking can likely improve performance, only 17% of Housing officers and Business officers have access to such information. Sixty-five percent of stakeholders would like to be able to benchmark their ResNet services.

Residential Networking, like most technologies, is a dynamic field with unforeseen opportunities and threats. Throughout the years of this study, schools have struggled with these compounding issues: the explosion of devices; increasing demand for bandwidth; video streaming; ed-tech; growth of IoT; the use of smartphones; expectations for campus-wide wireless; information security breaches, and budget restraints.

Colleges and universities always need foresight and flexibility to meet the rapidly changing circumstances. The pressure to satisfy the demands of today's students becomes apparent as stakeholders engage in the strategic planning process earlier and more often.

Twenty-one percent of schools update their strategic plans for ResNet *annually*, while 7% update it biennially. Nonetheless, one in four schools indicated their campus does not have a strategic plan for ResNet. And another 13% are unsure whether they have a strategic plan or how often it's updated.

Strategic Plan for ResNet

	2019	2018	2017	2016	2015
updated annually	20.7%	16.9%	23.5%	19.7%	13.0%
updated every 2 yrs	6.7%	4.9%	12.2%	9.4%	28.5%
updated every 3-5 yrs	33.3%	30.0%	26.3%	29.0%	30.1%
do not have a plan	26.0%	28.1%	27.2%	31.6%	9.2%
unsure if have one	13.0%	20.2%	10.8%	10.3%	20.2%
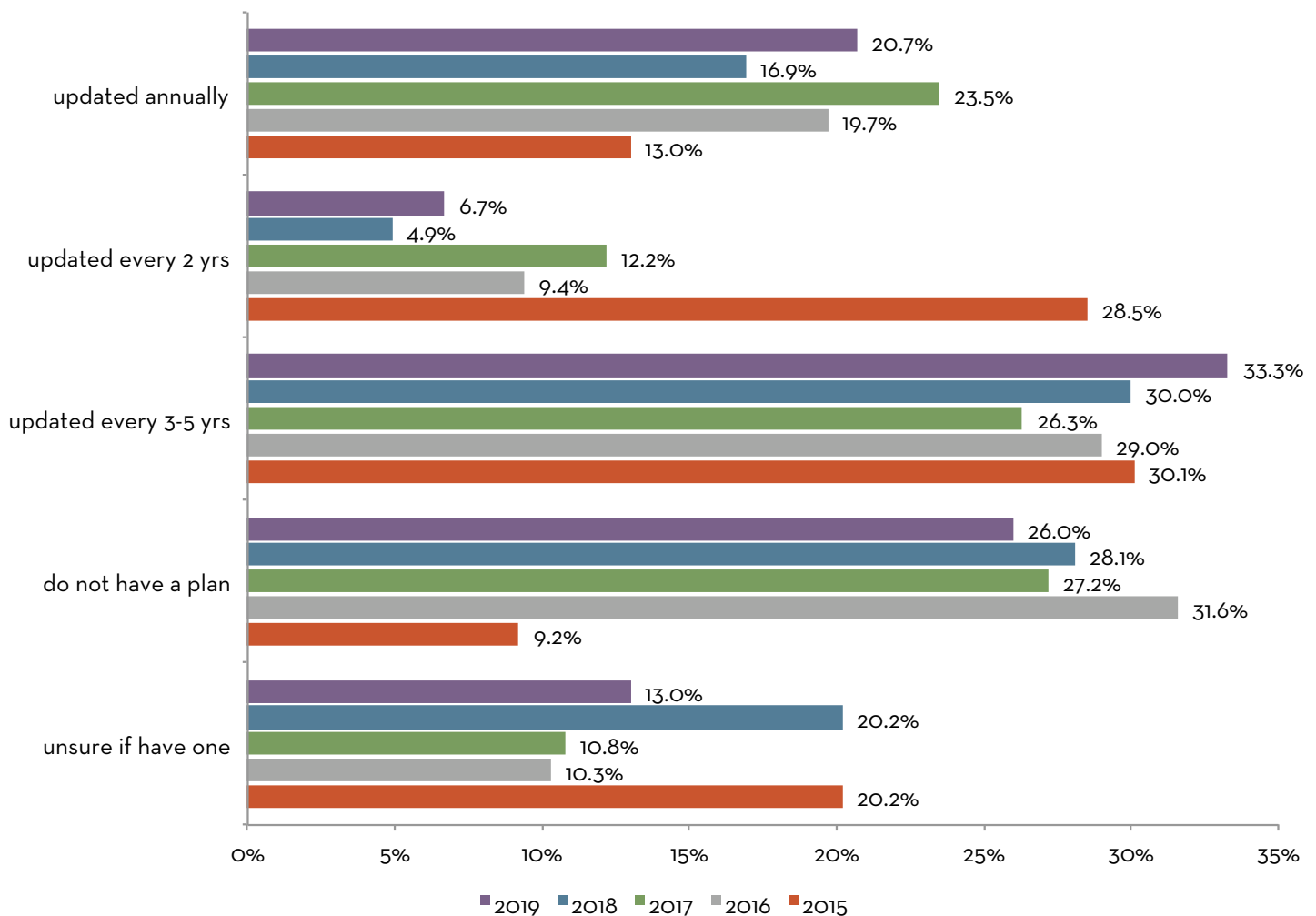
Communication Between Departments

Campus wireless networks have evolved over the last few years to become the primary network access for students, as well as faculty and staff. Successfully managing thousands of access points to serve a mobile device-centric audience is challenging because the wireless networks can no longer just be "good enough." Instead, the campus community expects a speedy, ubiquitous (including residential areas), and secure network with seamless roaming.

A successful, campus-wide wireless network must start with proper planning. It's also critical that all ResNet stakeholders collaboratively plan for the new era of networks and communications. Business, housing, and IT officers need to "interface" with their counterparts regarding the quality and performance of their ResNet operations. The "connection" has improved in the past year, but 21% of Housing officers and 16% of Business officers do not meet with their IT department at all. More than half of IT and Housing officers meet bi-weekly or bi-annually.

Frequency of Communication Among Key ResNet Decision Makers

Technology Officers Meet with Housing

Year	Meet annually or not at all	Meet bi-weekly to bi-annually
2019	42.0%	58.0%
2018	51.0%	49.0%
2017	56.1%	44.0%
2016	45.7%	54.3%
2015	49.4%	51.0%

Housing Officers Meet with IT

Year	Meet annually or not at all	Meet bi-weekly to bi-annually
2019	48.0%	52.0%
2018	48.6%	51.4%
2017	47.2%	52.8%
2016	43.6%	56.4%
2015	34.3%	65.8%

Business Officers Meet with IT

Year	Meet annually or not at all	Meet bi-weekly to bi-annually
2019	53.8%	46.2%
2018	40.3%	59.7%
2017	39.3%	60.7%
2016	42.3%	57.6%
2015	54.9%	45.1%

■ Meet annually or not at all   ■ Meet bi-weekly to bi-annually

Level of Satisfaction with ResNet Services

ResNet is a key driver in student satisfaction and school revenue. A high performing wireless network and sufficient bandwidth are no longer "nice to have" but is fundamental to education, a vital component to remaining competitive as a college and ensuring a positive student experience.

Most users are not interested in the engineering of the IT networks or its brand of hardware; instead they simply want fast, reliable, and easy access to online resources, applications, and entertainment. But these demands are continually growing, and housing officers are keeping watch. Previously we learned the majority of institutions measure student satisfaction with ResNet services, and it's typically housing and residence life that takes on this task. This study also measures and tracks the housing

officer's satisfaction with the overall performance of the ResNet services available to their on-campus residents.

Satisfaction among Housing officers has remained relatively consistent throughout the years, although this year shows a slight decrease in satisfaction almost across the board.

Housing Officer Satisfaction with ResNet Services (Average Rating)

Category	2019	2018	2017	2016	2015
Reliability (uptime)	8.2	8.2	8.7	8.7	8.5
Performance (speed)	7.9	8.1	8.6	8.4	7.9
Security	8.4	8.7	8.8	8.8	8.7
Cost	7.6	8	8	7.2	7.8
Service response time	8	8.1	8	7.4	8
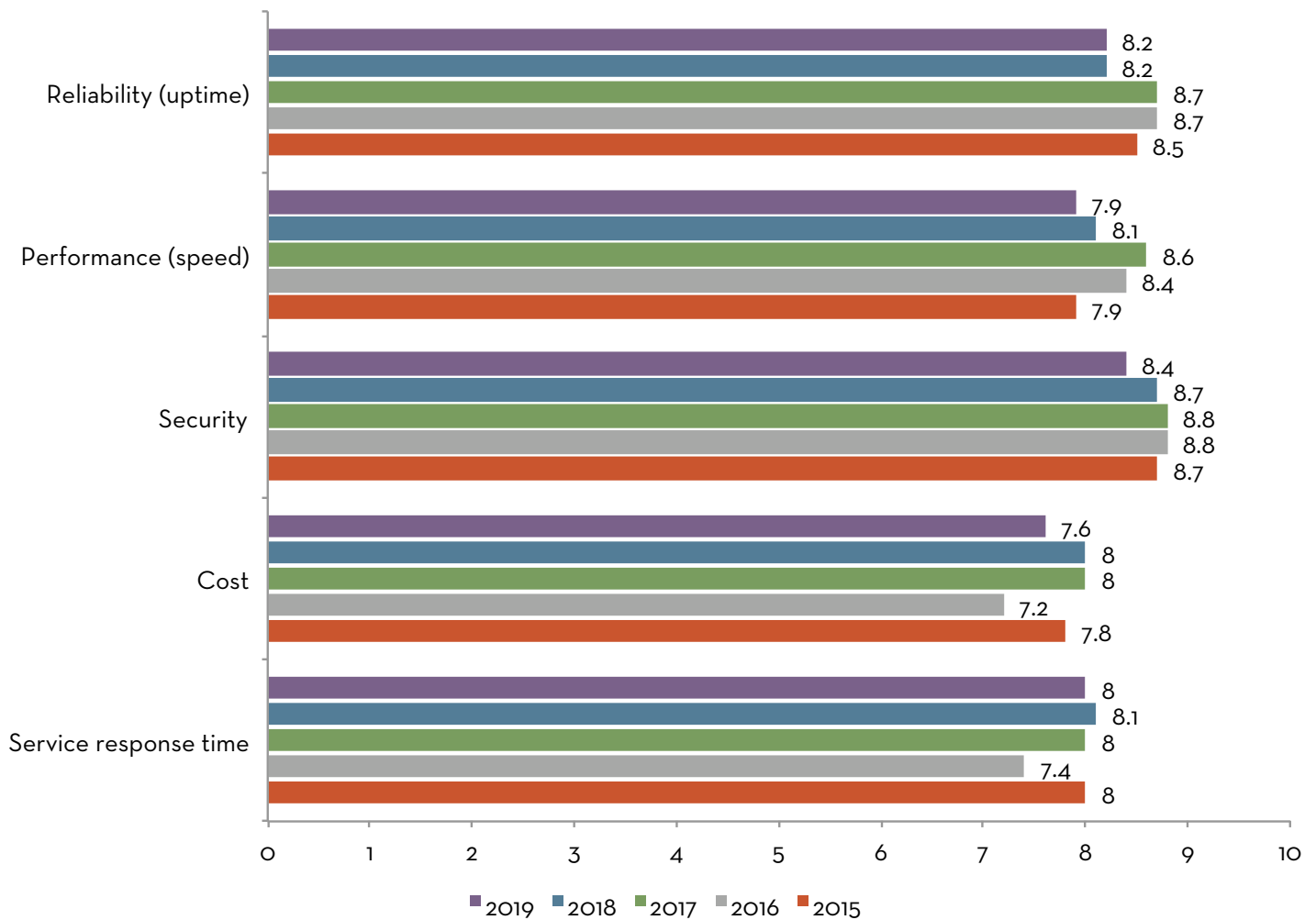
Diagnostics

Technology is only going to get better, faster, and more diverse. Campus networks need to be able to adapt to new devices, applications, prevent security threats, and perform critical system updates to ensure reliability, performance, and security throughout the entire campus.
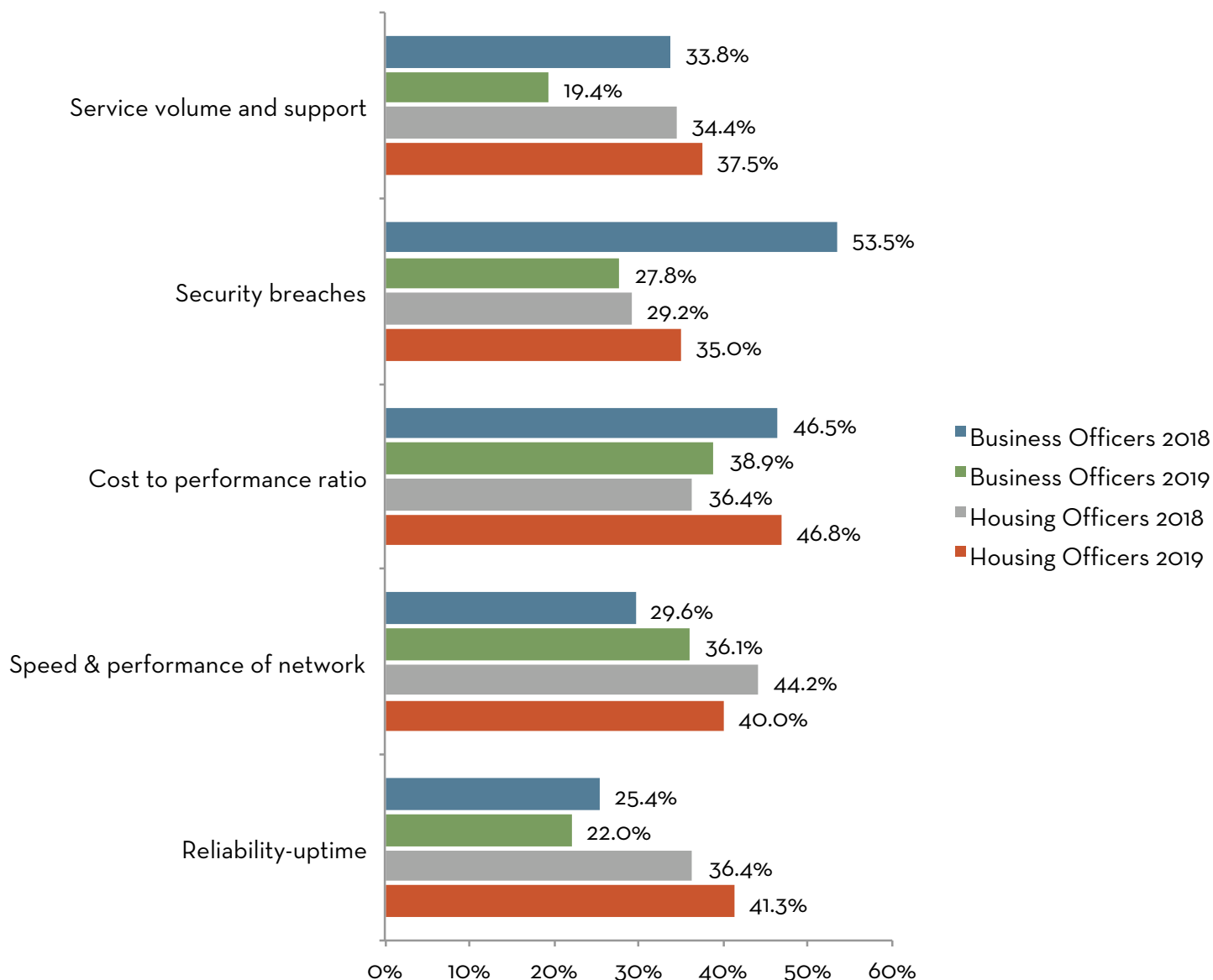
Network planning becomes a continuous exercise where updates are based on what's happening now. A dynamic strategic plan evolves as initiatives are executed, and feedback informs decisions about viable strategies. Measurements and reporting can be a critical component of network planning that lead to prioritized work and optimized resources.

Rapidly changing technologies make benchmarking essential for optimum wireless management. Benchmarking is not only a means to enhance wireless services by rectifying specific network problems and ensuring ongoing quality, benchmarking against other schools provides a competitive advantage. It's often high on the list for IT, but 65% of housing officers and chief business officers say they also want to benchmark their ResNet services. Unfortunately, slightly more than half (52%) do not have access to such information; another 31% are unsure if they have available benchmarking data.

The below chart demonstrates a shift in the diagnostic needs of business officers and housing officers over the last year. In 2018, housing officers placed more value on user satisfaction; with needs for reports and diagnostics on headcount, speed and performance, and reliability (uptime). Business officers had a stronger preference for cost-to-performance ratio and security breaches. This year's data confirms housing officers are becoming increasingly concerned with costs and security, along with end-user satisfaction.

Diagnostic Needs of Housing and Business Officers

Chart legend:
- Business Officers 2018
- Business Officers 2019
- Housing Officers 2018
- Housing Officers 2019

Service volume and support:
- 33.8%
- 19.4%
- 34.4%
- 37.5%

Security breaches:
- 53.5%
- 27.8%
- 29.2%
- 35.0%

Cost to performance ratio:
- 46.5%
- 38.9%
- 36.4%
- 46.8%

Speed & performance of network:
- 29.6%
- 36.1%
- 44.2%
- 40.0%

Reliability-uptime:
- 25.4%
- 22.0%
- 36.4%
- 41.3%

Business officers have upped their need to learn about the performance (speed) of their ResNet. For the past four years, security information ranked second in importance. It now drops to third. However, reliability, performance, and security information have consistently ranked above cost. The following table ranks each factor by importance and provides a score, which is the sum of all weighted rank counts.

Drivers of IT Telecommunications and Networking Services Ranked by Importance – Business Officers

	Rank	Weighted Score
Reliability (uptime)	1	193
Performance (speed)	2	165
Security	3	162
Operating Cost Pre-dictability	4	118
Capital Cost Predict-ability	5	97

Diagnostic information available to business officers doubled over the past five years. This year, 39% of business officers report satisfaction with the information they obtain compared to 17% in 2015. Performance (speed) ranks #2 in importance for service attributes with 36% of business officers indicating the need for more speed information, reinforcing the need for business officers to meet more frequently with IT, as well as housing officers.

Data Security

Housing officers reported growing need for security breach information is due to data security becoming an increasing priority on college campuses. In light of recent high-profile data breaches, 66% of schools report increased concerns over protecting student data and privacy. Defending a network from sophisticated cyberattacks requires hardware, software, and applications, in addition to staff and expertise that universities might not have access to. Eight percent of universities and colleges do not have an Information Security Officer and Internal Audit team, leaving them vulnerable. Fifty-five percent have a team of between 1 and 4 staff members and 23% have a team of between 5 and 9. The prospect of protective digital privacy measures being managed by a third-party may be the answer to increasing complex evolution of malware, zero-day attacks and other threats.

Funding and Technology Costs

Key takeaways:

- An increasing number of respondents expect wireless costs to grow by larger and larger percentages. Sixty-two percent of all institutions expect the cost of wireless network services to increase over the next two years, with 43% expecting an increase in cost of 5% or more.

- Budgets are being stretched to expand Wi-Fi coverage to meet student expectations. Annual IT budgets over $2.5 million have nearly tripled in the past year.

- Still, more than half of technology officers surveyed are concerned that capital funding for network infrastructure and budget will affect network management and performance.

- Twenty-one percent of housing officers indicated they *don't know* how the cost of providing wireless services on campus will change over the next two years. Their unclear picture of future ResNet costs inevitably makes strategic planning difficult.

- Sixty-eight percent of business officers experience growing concerns about Wi-Fi management budgeting (a 10% increase from 2017).

- As schools struggle to make ends meet, more and more find outsourcing to be the solution to rising ResNet costs – the number of schools outsourcing some or all of ResNet services has nearly doubled over the last five years.
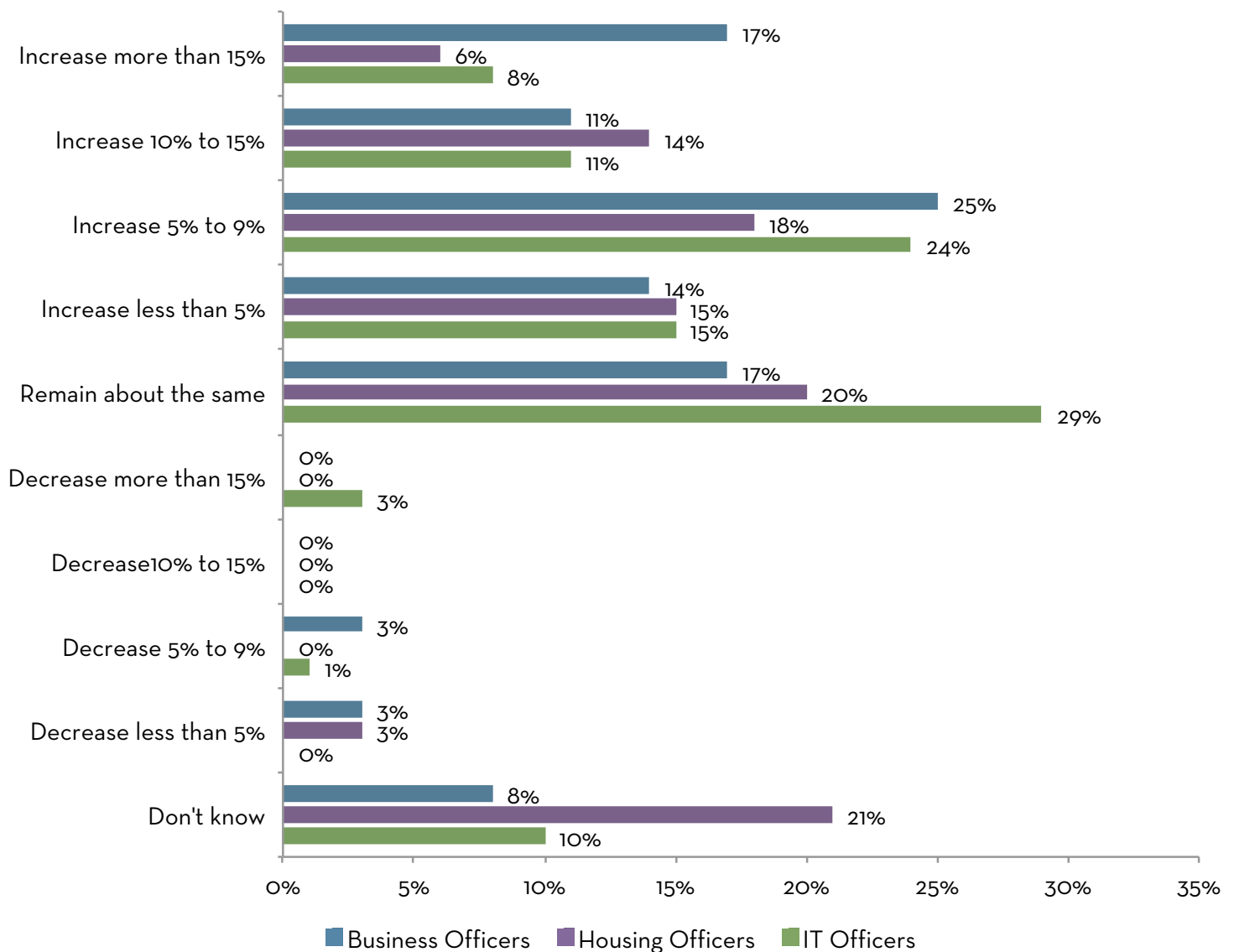
Campus technology is a big selling point for today's students and parents. Schools are reconfiguring classrooms for new technology, installing new equipment to support EdTech, and building wireless infrastructures to connect the permeating mobile devices on campus. All of these upgrades require a large budget, extensive planning, and years to accomplish. And when it's all said and done, they will need updating. It's a game of cat-and-mouse involving constant pursuit from business leaders, housing administrators, and IT.

More schools expect the cost of wireless network services to grow over the next two years, and they expect it to grow at a more drastic rate. Sixty percent of all institutions expect an increase, compared to 53% in 2018. Forty-three percent of schools are anticipating a rise in cost of 5% or more – an increase of 6% from 2018. Fifteen percent of institutions expect an increased cost of wireless network services at 15% or more (11% in 2018).

Two out of three business officers expressed increased concern for Wi-Fi management and budgeting compared to five years ago. Business officers have a more dispiriting outlook for the future costs of wireless (see chart below) with 67% expecting an increase. While the three stakeholder groups have somewhat different outlooks, 21% of housing officers *do not know* how ResNet costs may look in two years.

Cost Expectations for Wireless Network

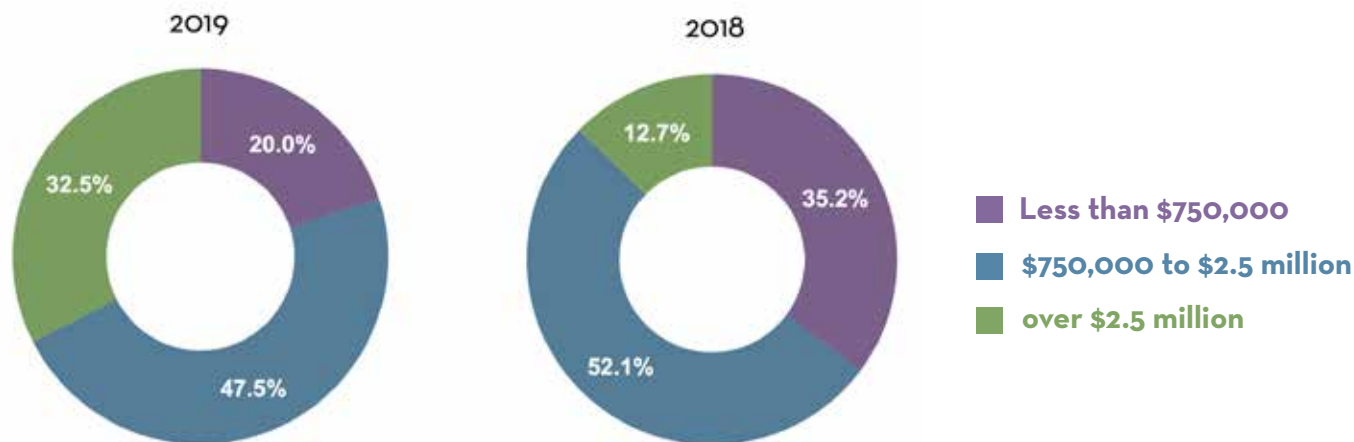| Category	Business Officers	Housing Officers	IT Officers
Increase more than 15%	17%	6%	8%
Increase 10% to 15%	11%	14%	11%
Increase 5% to 9%	25%	18%	24%
Increase less than 5%	14%	15%	15%
Remain about the same	17%	20%	29%
Decrease more than 15%	0%	0%	3%
Decrease 10% to 15%	0%	0%	0%
Decrease 5% to 9%	3%	0%	1%
Decrease less than 5%	3%	3%	0%
Don't know	8%	21%	10%

■ Business Officers ■ Housing Officers ■ IT Officers

Twenty-nine percent of IT officers see the future costs of wireless remaining the same. Still, they express increasing concerns over the potential of funding to impact the way they manage the network. Sixty-six percent of technology officers have concerns that the capital funding for network infrastructure will affect its performance. Fifty-four percent believe budget and cost predictability may cause a roadblock. Additionally, 34.4% have concerns the lack of funds for network support and help desks will impact their work. Inevitably, these concerns can sway student satisfaction with IT networking and communications on campus.

Who Pays for ResNet Costs & How Are Costs Recovered

Schools are dedicating bigger budgets to meet the growing demands for on-campus technology and networking services. With more schools working toward *everywhere wireless*, annual budgets over $2.5 million have nearly tripled, and mid-sized budgets stayed reasonably consistent over the past year. The size of operating and capital costs logically reflects the number of students. At the same time, the size of schools is relatively consistent over the years.

Annual Budget for Telecommunications and Network Services

2019
- 20.0%
- 32.5%
- 47.5%

2018
- 12.7%
- 35.2%
- 52.1%

Legend:
- Less than $750,000
- $750,000 to $2.5 million
- over $2.5 million

The budget for IT networking covers infrastructure, hardware, software, cloud services, support and maintenance upgrades, to name a few. To meet costs and ensure long-term budget stability, the majority of schools use mixed resources. This year shows an increase in schools jointly funding the IT network centrally through student fees and departments or partially funding centrally or through departmental assistance. Fewer schools are relying on central university funds to be the only source of network funding.

Funding models typically follow the size and type of university. Small, mainly private institutions fund centrally, and medium to large, predominantly public institutions implement a fee and recharge system.

Funding Models for Campus Telecommunications and Network Services

	2019	2018	2017	2016	2015
Completely fund the network as a core university service from central university funds.	27.5%	36.7%	42.4%	41.5%	47.4%
Partially fund with student fees and partially through central university funds.	25.0%	26.8%	30.6%	33.3%	28.6%
Jointly fund the network through central university, student fees and departments.	32.5%	22.5%	18.8%	17.1%	15.1%
Partially fund by departmental assistance (colleges and schools) and partially funded by central university funds.	10.0%	5.6%	4.7%	4.9%	4.2%

Even with the overall price continually escalating, tuition seldom covers the myriad of practical (and lavish) amenities. Some schools trim their budget to eliminate hikes in tuition costs. But the explosion of digital and mobile devices and their applications are requiring schools to spend more money on IT infrastructure and services to satisfy students and stay competitive with other colleges. To remain transparent, the majority of schools charge a technology fee to recoup the high costs of the new era of networking. Half of schools levy a general technology fee to on-campus students only, while 8.8% charge both on- and off-campus students. In contrast, 32% of schools do not implement a general technology fee – a consistent number over the years.

How Institutions Levy General Technology Fee
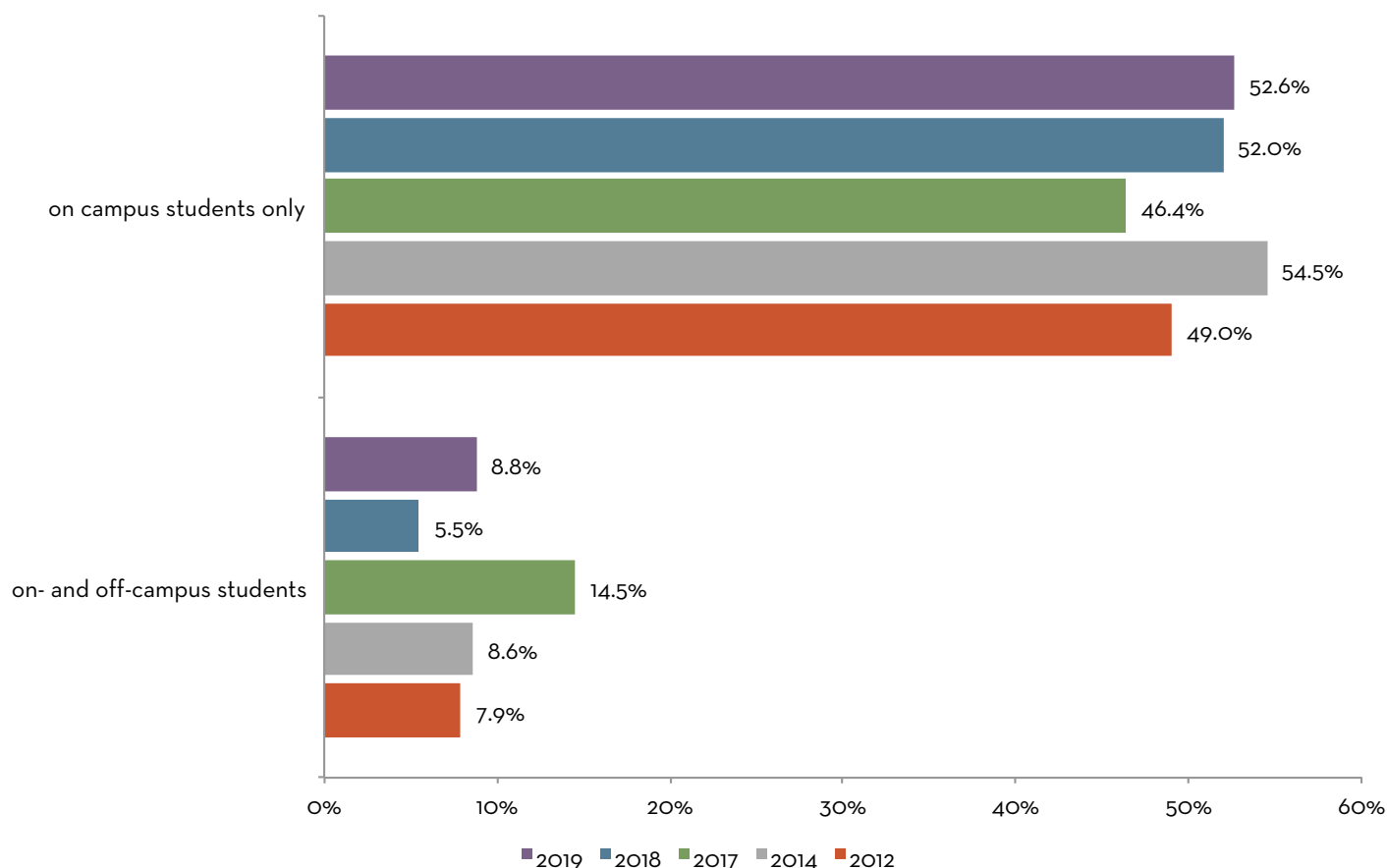
More schools address the cost of ResNet by combining network services with other IT services (35%) or through shaping bandwidth (28%). But these cost-saving approaches have declined over the years. Instead, more schools are outsourcing some or all ResNet services for better budgeting. Today, 21% of schools outsource ResNet to control costs compared to 12% in 2015.
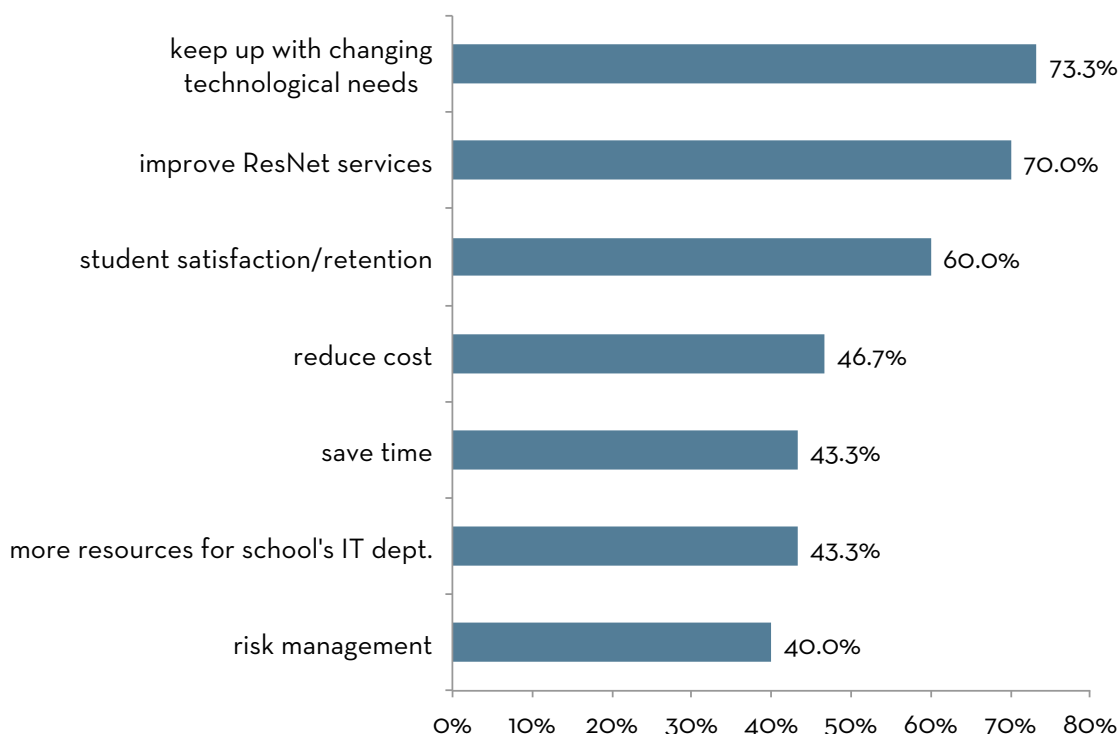
Key takeaways:

- More schools are seeing outsourcing as a viable solution to an ever-evolving technology landscape. As of this year, 16% of schools outsource their ResNet services, a 6% increase from 2016. And nearly 7% of schools are now outsourcing their academic/administrative networks.

- Cable TV is the most outsourced service, with 61% currently outsourcing. IPTV outsourcing shows a dramatic increase – a jump to 30% this year, a 22% increase since 2016.

- Keeping up with evolving technology, improving ResNet services and student satisfaction/retention are the top three reasons universities cite for choosing to outsource.

Many schools have upgraded to a campus-wide wireless infrastructure and other schools are in early planning stages. However, today's Wi-Fi environments pose unique challenges that require on-going planning and upgrading – some say every four years.

Juggling a multitude of priorities, more schools are seeing outsourcing as a viable solution to an ever-evolving technology landscape. Through economies of scale, independent providers can offer expertise and specialized services more effectively, though it appears schools are more concerned about ResNet performance rather than cost when it comes to outsourcing. Keeping up with evolving technology and improving ResNet services and are the top reasons universities cite for choosing to outsource.

Why Do Institutions Outsource ResNet?

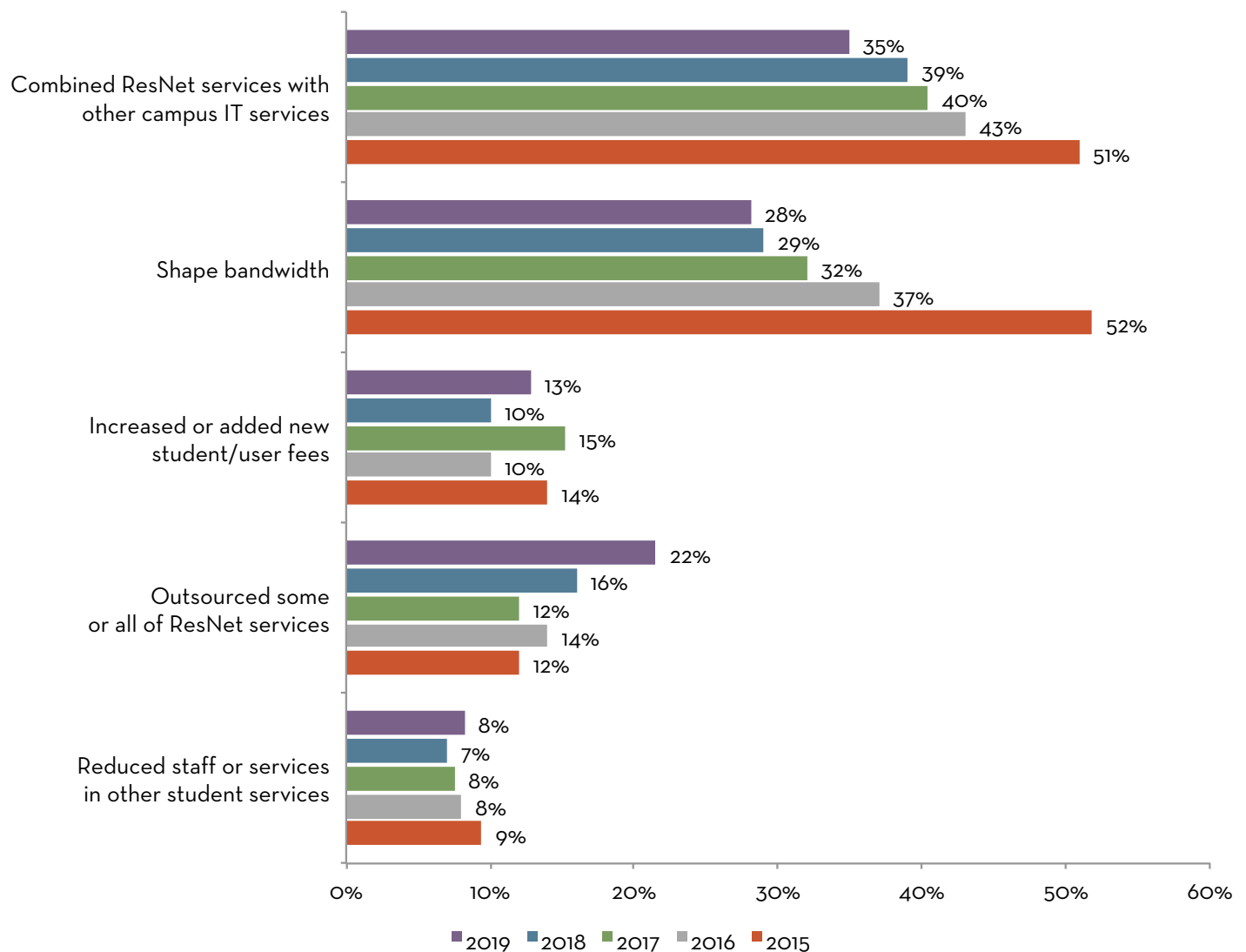| Reason	Percentage
keep up with changing technological needs	73.3%
improve ResNet services	70.0%
student satisfaction/retention	60.0%
reduce cost	46.7%
save time	43.3%
more resources for school's IT dept.	43.3%
risk management	40.0%

0%   10%   20%   30%   40%   50%   60%   70%   80%

While cost is not the top reason schools outsource ResNet, as schools struggle to make ends meet, more and more find outsourcing to be the solution to rising ResNet costs. The number of schools outsourcing some or all of ResNet services (which includes but is not limited to phone, cable, help desk, etc.) to reduce costs has nearly doubled over the last five years to 22%.

How Schools Address ResNet Costs

Combined ResNet services with other campus IT services
- 2019: 35%
- 2018: 39%
- 2017: 40%
- 2016: 43%
- 2015: 51%

Shape bandwidth
- 2019: 28%
- 2018: 29%
- 2017: 32%
- 2016: 37%
- 2015: 52%

Increased or added new student/user fees
- 2019: 13%
- 2018: 10%
- 2017: 15%
- 2016: 10%
- 2015: 14%

Outsourced some or all of ResNet services
- 2019: 22%
- 2018: 16%
- 2017: 12%
- 2016: 14%
- 2015: 12%

Reduced staff or services in other student services
- 2019: 8%
- 2018: 7%
- 2017: 8%
- 2016: 8%
- 2015: 9%

Legend: 2019, 2018, 2017, 2016, 2015

In ResNet outsourcing, schools have the option to either outsource an entire network operation or outsource one or more of its services. Cable TV is still the most commonly outsourced service, coming in over ResNet and phone service. At the same time, there is a measurable rise in outsourced IPTV on campus which is predicted to replace traditional cable television because of its flexibility and more sophisticated applications.

Forty-five percent of schools do not offer any phone service to residential students. Still, a steady number of schools (19%) continue to outsource phone services over the years with an increase in VoIP. When it comes to ResNet outsourcing, schools report that some of the key benefits of relying on a vendor, or third-party include:

- Less likely to require bandwidth management practices. The research shows that just 38% of colleges that outsource their ResNet or Internet need to manage bandwidth, a figure significantly lower than schools the don't outsource. For those that keep ResNet in-house, three out of four schools implement bandwidth management practices.

- Provide better—and more flexible—help desk service and support. Seventy percent of schools that outsource ResNet provide 24/7 support compared to just 15% of schools with in-house networks.
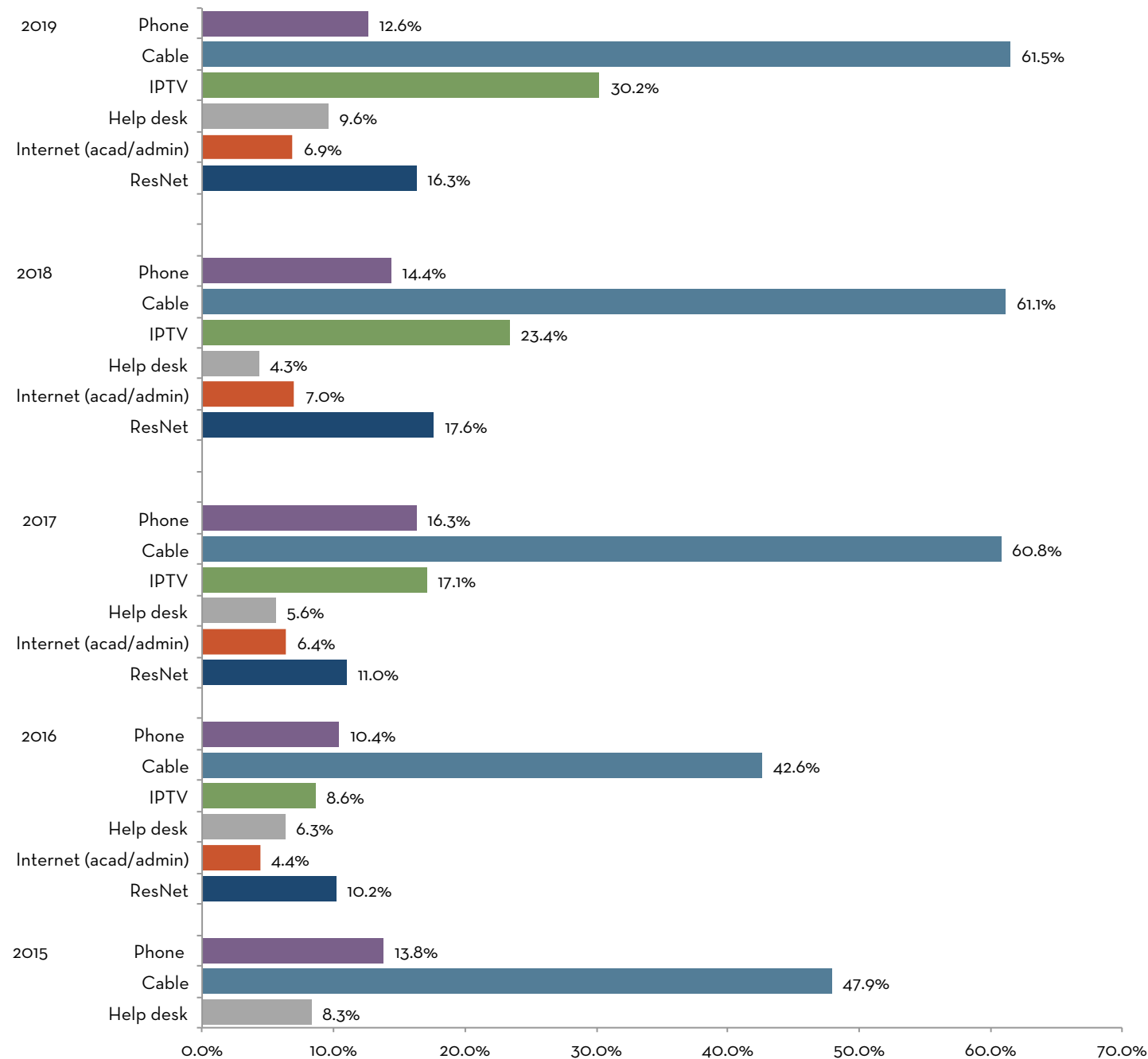
More Outsourcing, Not Just for ResNet

Beyond the ResNet, outsourcing of the administrative network is also on the rise. This year, nearly 7% of schools are outsourcing internet for academic, administrative and non-residential parts of campus, a rise from 4.4% in 2016.

What's more, we're also seeing an increase in help desk outsourcing. Since nothing frustrates a student more than poor IT support in their time of need, help desk services and support are being outsourced more by higher education institutions in order to improve the process, service and cost. Ten percent of surveyed institutions currently outsource help-desk services, and another 3% are considering outsourcing.

Percentage of Institutions Outsourcing ResNet Services

2019

Service	Percentage
Phone	12.6%
Cable	61.5%
IPTV	30.2%
Help desk	9.6%
Internet (acad/admin)	6.9%
ResNet	16.3%

2018

Service	Percentage
Phone	14.4%
Cable	61.1%
IPTV	23.4%
Help desk	4.3%
Internet (acad/admin)	7.0%
ResNet	17.6%

2017

Service	Percentage
Phone	16.3%
Cable	60.8%
IPTV	17.1%
Help desk	5.6%
Internet (acad/admin)	6.4%
ResNet	11.0%

2016

Service	Percentage
Phone	10.4%
Cable	42.6%
IPTV	8.6%
Help desk	6.3%
Internet (acad/admin)	4.4%
ResNet	10.2%

2015

Service	Percentage
Phone	13.8%
Cable	47.9%
Help desk	8.3%

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