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STATE CIO

ABOUT THE AUTHORS

ABOUT THE NATIONAL ASSOCIATION OF STATE CHIEF INFORMATION OFFICERS

Founded in 1969, the National Association of State Chief Information Officers (NASCIO) represents state chief information officers (CIOs) and information technology (IT) executives and managers from the states, territories and District of Columbia. NASCIO's mission is to foster government excellence through quality business practices, information management and technology policy. NASCIO provides state CIOs and state members with products and services designed to support the challenging role of the state CIO, stimulate the exchange of information and promote the adoption of IT best practices and innovations. From national conferences to peer networking, research and publications, briefings and government affairs, NASCIO is the premier network and resource for state CIOs. For more information, visit www.NASCIO.org.

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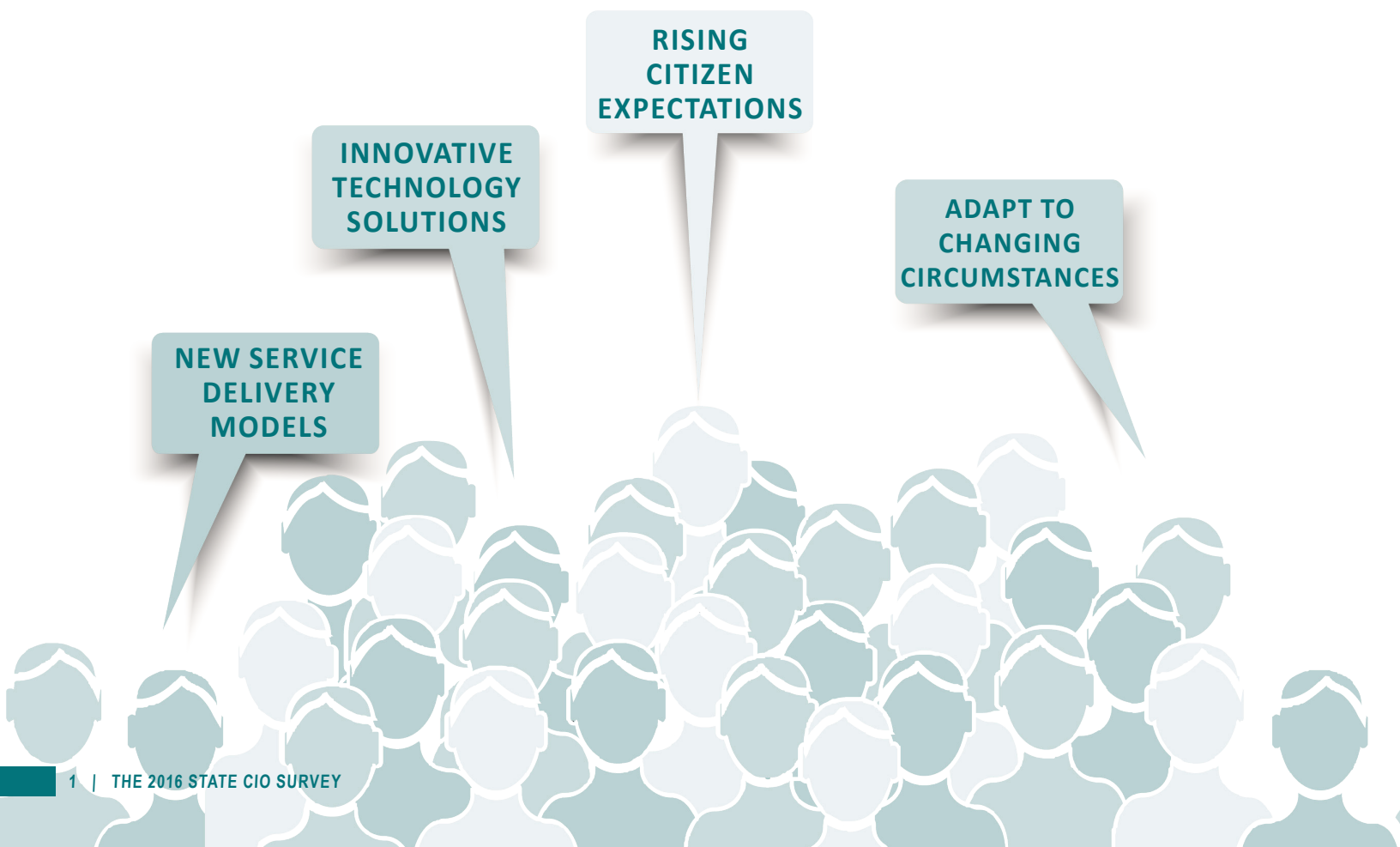
EXECUTIVE SUMMARY

New service delivery models, innovative technology solutions, and rising customer expectations all require state CIOs to adapt continually to changing circumstances. We asked state CIOs to share their perspective on a number of topics, with a particular focus on the continued evolution of the CIO as a broker of shared services, on the IT workforce challenges facing CIOs, and on the use of data management and analytics at an enterprise level. These topics all involve CIOs looking into the future and adapting their strategies and plans to address a state IT and business environment that is becoming ever more complex.

BUSINESS MODELS, SOURCING AND THE CIO AS BROKER

Since 2010 we have asked CIOs to tell us what business models they are using to deliver IT services. Over that time period there has been a steady progression towards data center consolidation and increased use of outsourcing, particularly for IT applications and services. While approximately one-third of states continue to own and operate all IT assets and operations, over two-thirds of states now outsource at least some IT

infrastructure operations, and almost two-thirds use a managed services model for some or all IT operations. Four out of five states also outsource at least some IT applications and services, a significant increase from the 42% reported in 2010. The use of a shared services model for provision of IT services has now become the norm with three-quarters of states using that model, up from 66% in 2010.

We also asked CIOs about their business model and sourcing plans for the future, and for the most part, we see a continued reduction in state-owned-and-operated data centers and a continued increase in outsourcing, including an expanded use of IT shared services and managed services. We are seeing a few states however that are looking to scale back outsourcing and to increase the number of state staff delivering services. It is notable that almost one in five CIOs expected that certain specific operations that are currently outsourced would be brought back in-house. This may reflect lessons learned from a first generation of outsourcing contracts and reflect a better appreciation of what types of services are a better fit for outsourcing.

RISING CITIZEN EXPECTATIONS

INNOVATIVE TECHNOLOGY SOLUTIONS

ADAPT TO CHANGING CIRCUMSTANCES

NEW SERVICE DELIVERY MODELS

We also asked CIOs whether they planned to move their organization toward a managed services model. We asked this question in last year's survey as well, and this year's responses show the same general trend – a continued movement toward some type of managed services model in most states. As one CIO said "We don't build or develop anything, we buy things that are SaaS or COTS services. Our CIO serves as an IT facilitator vs. provider." However, there were also some differences. In particular, a number of states appear to be graduating from the planning stages and either moving forward with decisions to adopt managed services or deciding not to pursue the model. This may be due to changes in leadership or due to experiences with pilot projects that have prompted a change in approach.

DATA MANAGEMENT AND ANALYTICS

The overwhelming majority of CIOs consider data governance and management to be a key element of their strategic agendas and operational plans. There has been significant progress in this area in the last several years. In 2015, less than 5% of respondents stated that they had formal data management policies and practices in place. The 2016 survey revealed that 45% of respondents now have data governance policies in place, and 23% have implemented a formal data governance organization. However, there is still significant work to do in this area. While 71% of states have established standards for data classification and security, only 18% have data management and metadata standards in place, and only 25% have a strategy to deal with large volumes of data.

We also asked CIOs specifically about the role of the Chief Data Officer (CDO), and whether a statewide Master Person Initiative was being pursued in their states. Only one-third of states have created a CDO position, although another 20% of states are considering creating one. Interestingly, states take different approaches to locating the CDO, with CDOs reporting to the CIO twice as common as those reporting to a different element of the state government. Very few states currently have an active Master Person Index, although approximately 20% of states are either currently implementing one or expect such an initiative to begin shortly. The remaining states are roughly evenly split between discussions on the topic and no plans to pursue in the next year.

As data management strategies and practices have evolved over time, the inclusion of data analytics across states has become more apparent and relevant. We asked CIOs about the extent of their deployment of data analytics in their state. 73% of respondents indicated their state has deployed some data analytics capabilities in certain agencies, but only 7% categorized their state's maturity and usage in the higher categories as a highly invested state with substantial capabilities in data analytics. However, the overwhelming majority of respondents indicated their state is integrating or has an interest in the integration of data analytics to develop insights and inform policy decisions.

IT WORKFORCE

It is widely reported that the landscape of today's workforce is changing. Has the so-called "Silver Tsunami" happened? Have millennials really changed the workforce that much (for better or for worse)? And what happens to all of those workers in-between? Indeed, the same questions come into play for the state government workforce, and especially the state IT workforce. For the first time in many years in this survey, we asked respondents about recruitment, retention, and personnel reform in their states and CIO offices and this was for many reasons. Each year NASCIO releases a State CIO Top 10 list of priorities and initiatives. For the last two years, and for the first time in many years, "human resources/talent management" has made that list. While NASCIO also issued a special workforce report in 2015, we wanted to ask additional in-depth and specific questions to see how states are confronting workforce changes.

In terms of reform options, we asked what single personnel reform could be implemented that would be the most impactful in reforming your state IT workforce? Not surprisingly, "modernizing IT job titles and classifications" ranked highest at 27%. For many years, state CIOs have lamented that a "one size fits all" job classification system in state human resources does not work for IT. CIOs also said that "modernizing office culture [i.e. flexible work schedules, telecommuting, and open office concepts]" would be a highly impactful reform. This is also not surprising as it seems that other sectors are increasingly offering a modern office environment and the workforce is demanding it.

We also asked what innovative/out-of-the-box strategies and tactics have states used in attracting and retaining a highly qualified IT workforce? By a landslide, the two most highly ranked answers here were, "promoting non-salary benefits" and "call to public service." This is also consistent with the 2015 NASCIO report on state IT workforce where one state CIO told us, "money isn't everything." Truly, state government knows that it cannot compete with the private sector on compensation. Rather, state CIOs are innovating and promoting the experiences that state IT can offer that the private sector cannot.

State government, especially state IT has faced challenges in the area of workforce recruitment, retention, and development. But states are innovating; states are rising to the challenge and states are attracting the best talent to meet the needs of the citizens they serve. As one CIO told us, "an organization that wants to improve can be exciting."

ABOUT THE SURVEY

SURVEY PURPOSE

The National Association of State Chief Information Officers (NASCIO), Grant Thornton LLP and CompTIA have collaborated for a seventh consecutive year to survey state government IT leaders on current issues, trends and perspectives. The survey sponsors seek to provide these state government IT leaders with an opportunity to voice their thoughts and opinions on matters of high importance. Governors, legislatures and business leaders can benefit from these knowledgeable insights about essential state IT services.

METHODOLOGY

In Spring 2016, the sponsors jointly developed a series of questions reflecting both the new issues of the day as well as follow-up on some of the questions they included in prior years' surveys. The questions were presented to state CIOs in an online tool, and between June and July 2016, they individually logged in and addressed the 43 multiple-choice and open-ended questions.

The response rate was excellent with 50 of the NASCIO member states and territories completing the survey. Primary respondents were the state CIOs, although deputy CIOs and other senior state IT leaders contributed. Throughout the survey, we refer to them all as state CIOs. Thirty-five of the respondents also participated in the 2015 survey. However, new perspectives were introduced by 28% of the respondents who are different due to the normal turnover that occurs in state CIO positions. We also conducted in-person interviews with 18 state CIOs and incorporated their "advice from the trenches" along with the quantitative and qualitative responses to the online survey.

ANONYMITY

This report reflects the responses and opinions of the survey respondents to the maximum extent possible. However, to preserve anonymity, we do not attribute responses to specific individuals.

To obtain a copy of the survey report or questionnaire, please see the inside back cover of this report for directions to the sponsor organizations' websites.
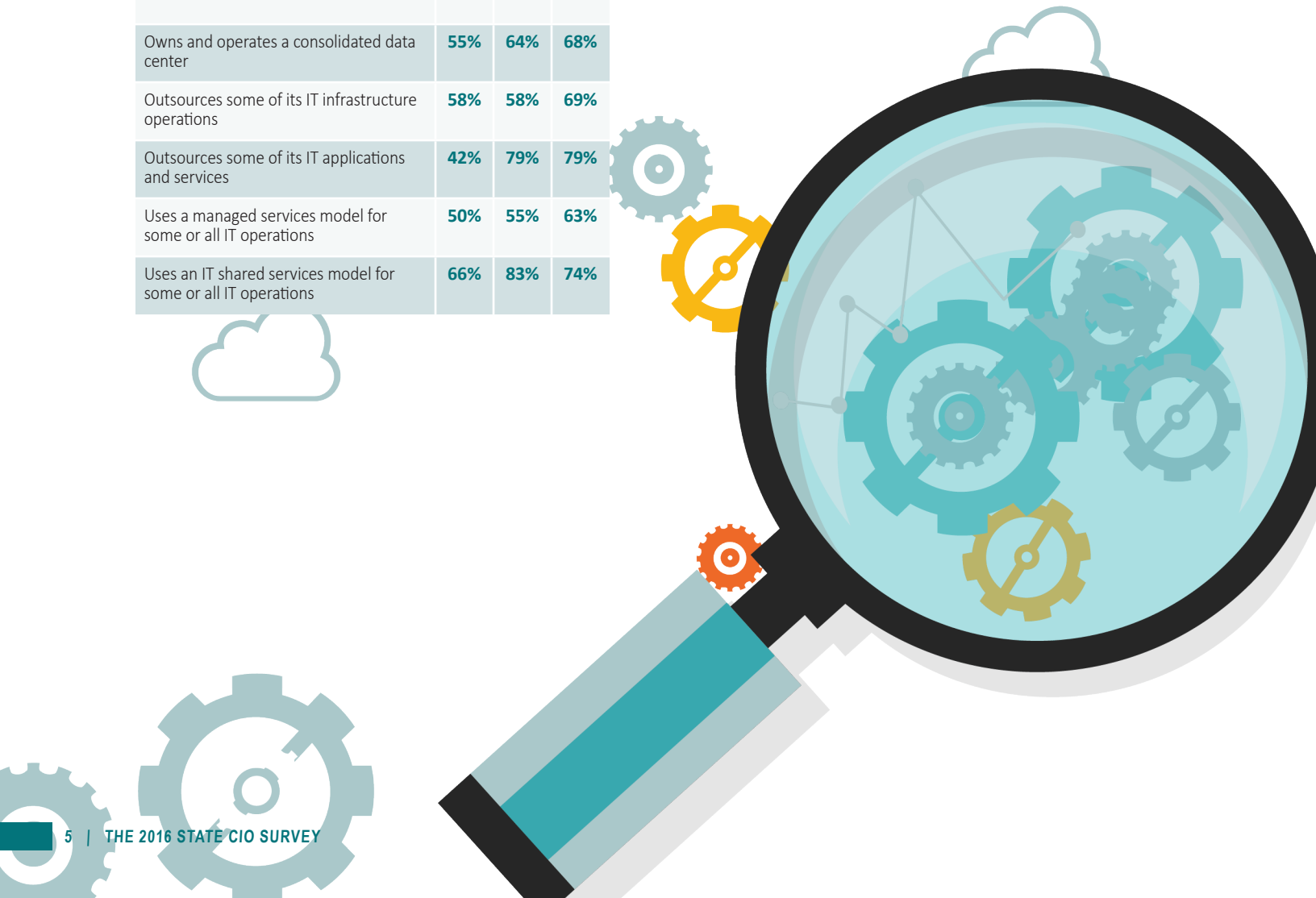
BUSINESS MODELS, SOURCING AND THE CIO AS BROKER

Since 2010 we have been asking CIOs to tell us what business models they are using to deliver IT services. As the table below shows, over that time period, there has been a steady progression towards data center consolidation and increased use of outsourcing, particularly for IT applications and services. While approximately one-third of states continue to own and operate all IT assets and operations, over two-thirds of states now outsource at least some IT infrastructure operations, and almost two-thirds use a managed services model for some or all IT operations. Four out of five states also outsource at least some IT applications and services, a significant increase from the 42% reported in 2010. The use of a shared services model for provision of IT services has now become the norm with three-quarters of states using that model, up from just 66% in 2010.

We also asked CIOs about their business model and sourcing plans for the future. As the table below shows, for the most part, we see a continued reduction in state-owned and operated data centers and a continued increase in outsourcing, including an expanded use of IT shared services and managed services. We are seeing a few states however that are looking to scale back outsourcing and to increase the number of state staff delivering services. It is notable that almost one in five CIOs expected that certain specific operations that are currently outsourced would be brought back in-house. This may reflect lessons learned from a first generation of outsourcing contracts and reflect a better appreciation of what types of services are a better fit for outsourcing. States are also looking at these decisions quantitatively. As one CIO commented "We're conducting a benchmarking exercise and looking at costs of the CIO providing services vs. outsourcing. The output is going to serve as our roadmap to migrate."

What business models and sourcing strategies does your state CIO organization currently use?	2010	2015	2016
Owns and operates all state IT assets and operations	32%	30%	31%
Owns and operates multiple data centers	58%	53%	54%
Owns and operates a consolidated data center	55%	64%	68%
Outsources some of its IT infrastructure operations	58%	58%	69%
Outsources some of its IT applications and services	42%	79%	79%
Uses a managed services model for some or all IT operations	50%	55%	63%
Uses an IT shared services model for some or all IT operations	66%	83%	74%

How does your state CIO organization plan to deliver or obtain IT services over the next three years (e.g., server and platform administration, backup, storage, software and hardware maintenance, network management and service desk management)?

	2015	2016
Expand existing IT shared services model	62%	72%
Outsource business applications through a SaaS model	55%	66%
Expand existing managed services model	53%	61%
Downsize state-owned-and-operated data center(s)	49%	28%
Expand outsourcing	43%	45%
Introduce a managed services model	26%	17%
In-source some operations that currently are outsourced	17%	19%
Introduce outsourcing as a new service model	15%	17%
Maintain the status quo	13%	11%
Introduce an IT shared services model	6%	13%
Build new data centers	2%	6%
Downsize or scale back existing managed services model	2%	2%
Increase state IT staff	2%	17%
Downsize or scale back outsourced operations	0%	8%
Downsize or scale back existing IT shared services model	0%	2%

To focus more specifically on plans for the use of managed services models, we asked CIOs whether they planned to move their organization toward a managed services model. We also asked this question in last year's survey, and this year's responses show the same general trend – a continued movement toward some type of managed services model in most states. As one CIO said "We don't build or develop anything, we buy things that are SaaS or COTS services. Our CIO serves as an IT facilitator vs. provider."

However, there were also some differences. In particular, a number of states appear to be graduating from the planning stages and either moving forward with decisions to adopt managed services or deciding not to pursue the model. This may be due to changes in leadership or due to experiences with pilot projects that have prompted a change in approach.

Does your organization intend to move toward a managed services model?

	2015	2016
Yes, we are expanding our existing IT services to include a hybrid managed services model	59%	55%
Yes, we are contemplating moving in this direction but are only in the planning stages	24%	10%
Yes, we are currently implementing a completely managed services model	7%	15%
Yes, we are contemplating moving toward a managed services model in the next year	7%	7%
No, we have no plans to adopt a managed services model	2%	15%
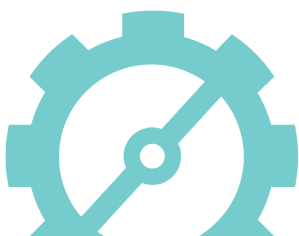
AGILE AND INCREMENTAL SOFTWARE DELIVERY

As we discussed in last year's survey, over the last several years there has been a pronounced movement in the private sector away from extended, traditional Waterfall lifecycle projects and towards the rapid delivery of software in an incremental fashion, often using Agile software development techniques. This transition is also beginning to happen in the public sector. We saw in last year's results that there was considerable activity in multiple states, but that most efforts are uncoordinated or are in a pilot phase.

We asked CIOs again this year how they would characterize the use of Agile or incremental software development approaches within their states. As the table below shows, there has been a significant decrease in the proportion of states where there is limited or entirely uncoordinated use of Agile or similar approach. More states are now either conducting pilot projects or engaging in widespread use with centralized guidance. This is reflective of a steady maturation within the state IT community in understanding how best to apply Agile principles and techniques.

How would you characterize the use of Agile or incremental software development approaches within your state?	2015	2016
Limited use, uncoordinated	34%	19%
Pilot/trial adoption on certain projects	32%	39%
Widespread use, but not subject to centralized oversight or guidelines	21%	19%
Widespread use, subject to centralized oversight or guidelines	9%	15%
No use	2%	2%
Do not know/does not apply	2%	6%

As we did last year, we also asked CIOs how successful they considered Agile and incremental approaches in their state to be, particularly compared to traditional "Waterfall" approaches. Interestingly, the results suggest that states are beginning to make up their minds on Agile, with fewer CIOs stating it is 'too early to tell,' more CIOs finding Agile superior to Waterfall approaches, but more CIOs also concluding Agile wasn't working for their state. These early conclusions may reflect CIOs' experiences with the first generation of Agile projects completed in their state, and may be revised as states gain additional data.

To the extent that Agile or incremental software development approaches have been followed on projects in your state, how would you characterize their success?	2015	2016
Too early to tell – not enough information to-date	62%	56%
These approaches were superior in success to Waterfall software development	22%	31%
These approaches were comparable in success to Waterfall software development	13%	16%
These approaches did not work for our state	2%	8%

To further investigate the factors that drive successful adoption of Agile approaches, we asked CIOs their views on the top three critical success factors for the adoption of Agile on projects. We added an additional option this year, 'Customer involvement and commitment,' and as the table below shows, this immediately rose to being considered the second critical factor. The other factors most commonly cited continued to be picking the right types of projects on which to employ Agile, effective training of staff, and the use of Agile-specific project management methods and tools. Some respondents also mentioned procurement as a key factor. One CIO described the situation as "The methodology is there but procurement hasn't caught up to that. The projects become time and materials efforts."

Where you have employed Agile or incremental software development approaches on projects, what were the top three critical success factors?	2015	2016
Picking the right type of projects on which to employ Agile	78%	79%
Customer involvement and commitment	NA	64%
Effective training of staff	70%	48%
Agile-specific project management methods and tools	68%	46%
Use of experienced Agile coaches	43%	34%
Use of supporting software tools to provide supporting data and metrics	14%	9%
Agile-specific procurement and contract management methods and tools	8%	9%

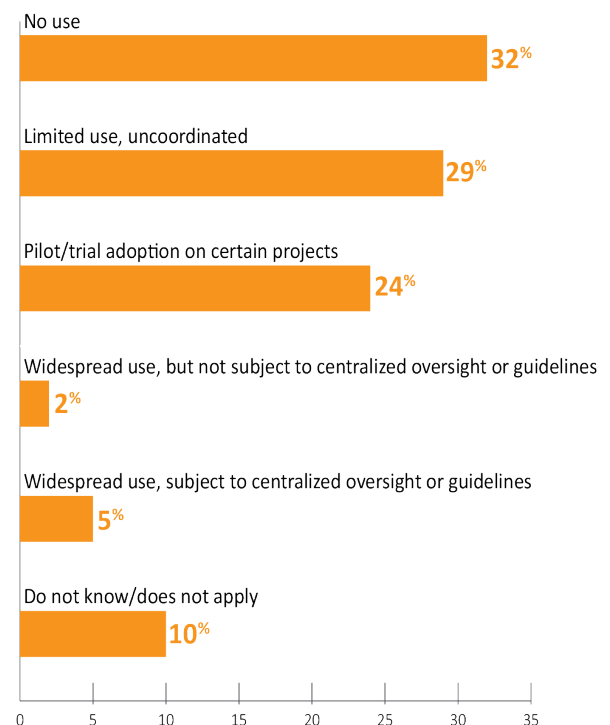We then asked CIOs, given their experience to-date, how they saw the use of Agile approaches changing in the next 12-24 months? As the figure below shows, over three-quarters of CIOs anticipate increased use of Agile software delivery approaches in the next couple of years. Agile continues to move more into the mainstream of state government IT, but there is still some way to go before best practices on the appropriate use of this approach in the states are widely understood. As one CIO commented "2/3 of my staff are trained in lean business processes, this lets them learn to think and question more. Agile development projects are still challenging for the business side, but I'd say 1/3 of our projects are Agile, and this is growing."

Finally, we asked CIOs about the use of DevOps. DevOps is a culture and practice that emphasizes automating the process of software delivery and infrastructure changes. It aims at establishing a culture and environment where building, testing, and releasing software can happen rapidly, frequently, and more reliably. Organizations with significant experience using Agile often view DevOps as a key contributor to the successful adoption of the Agile approach, and as a next step to becoming an 'Agile Enterprise.' We asked CIOs whether their state has implemented the practice of DevOps to support the entire service lifecycle. As the table below shows, implementation of DevOps is significantly more immature than the broader use of Agile. This will likely be an area where states will need to invest if they are to be successful in adopting Agile development practices.

Do you anticipate increased use of agile or incremental software development approaches in your state within the next 12-24 months?

81% Yes
4% No
15% Don't Know

Has your state implemented the practice of DevOps to support the entire service life cycle?

No use	32%
Limited use, uncoordinated	29%
Pilot/trial adoption on certain projects	24%
Widespread use, but not subject to centralized oversight or guidelines	2%
Widespread use, subject to centralized oversight or guidelines	5%
Do not know/does not apply	10%

INDEPENDENT VERIFICATION AND VALIDATION

In our 2014 survey, we asked CIOs to describe their processes for planning and overseeing large, critical projects. Almost two-thirds of CIOs in 2014 stated that some kind of Independent Verification and Validation (IV&V) was used on these projects, especially health and human services-related projects that involve the use of federal funds. This year, we asked CIOs to assess the value provided by these services and to identify those aspects of the IV&V role that they felt were most important.

As the table below shows, while almost 9-in-10 CIOs utilize IV&V services in some capacity, opinion varies widely on the value of IV&V services provided on major projects. Almost a third of CIOs felt IV&V provided significant value, but the most common opinion was that value was modest, and almost twenty percent of CIOs found little value given the cost. Some CIOs saw the timing of IV&V as a contributing factor to the value provides. As one CIO put it "IV&V is valuable as long as they aren't brought in too late. They need to be on board before the contract work starts. If IV&V is not incorporated in the beginning, disagreements will come up as to what the systems integrator should cover." It is also true that perceived value varies given the background and experience of the customer. One CIO stated, "When a project goes well, the agency sees no value in IV&V."
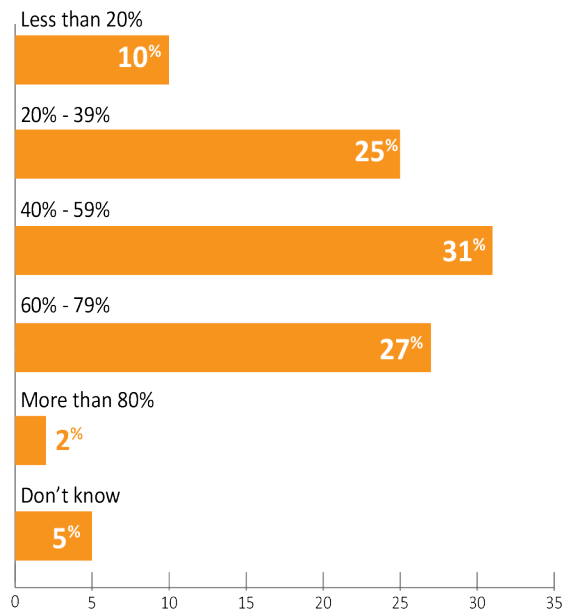
Given that IV&V services are seen to deliver value in many instances, we asked CIOs what duties of the IV&V provider they considered most important. As shown in the table below, the most valuable roles were seen to be acting as an independent advisor to assess the health of the project and to oversee the activities of vendor and state project teams. Monitoring adherence to standards and providing formal documentation was seen as less valuable.

RANK		SCORE
01	Providing truly independent assessments of the health of this project	215
02	Validating that the project vendors are effectively fulfilling their responsibilities and are providing the state with accurate information about project performance	189
03	Serving as an advisor to project management to help ensure that the project is successfully completed	179
04	Validating that state team members are effectively fulfilling their responsibilities and are providing accurate information about project performance	177
05	Formally documenting all matters that have the potential to adversely impact the success of the project	151
06	Validating that the project is being conducted in a manner consistent with relevant industry standards (IEEE 1012, PMBOK, etc.)	131

How would you rate the value of Independent Verification and Validation (IV&V) or similar project oversight services provided on your major projects?

Significant value - these services enabled major improvements in project execution and associated outcomes

29%

Some value - these services enabled modest improvements in project execution and associated outcomes

42%

Inconsequential or no value - these services did not yield commensurate value given the cost

17%

Not Applicable - we do not use these services

12%

0   10   20   30   40   50

LEGACY SYSTEM MODERNIZATION

We asked CIOs to describe the status of their IT application portfolio, and specifically to estimate what percentage of their IT systems could be considered "Legacy Systems" due for replacement or modernization. As shown in the table below, 90% of the CIOs considered at least 20% of their systems due for replacement or modernization, while nearly two-thirds of CIOs saw more than 40% of the systems as a legacy. Despite the tremendous efforts undertaken by states over the past decade to modernize systems, it is clear that much remains to be done. As one CIO put it "We're coming out of a period of time where we weren't investing in technology; we have a lot of catching up to do."

We also asked CIOs how much of their state's IT budget was dedicated to legacy system modernization. Over one-third of CIOs stated that greater than 10 percent of their budget is allocated to modernization work. States continue to focus efforts in areas where matching funds may be obtained. As one state CIO explained, "We're focused on areas where we are able to leverage federal dollars like for Medicaid with the 90/10 match."

What percentage of IT systems in your state are "Legacy Systems" due for replacement or modernization?

Category	Percentage
Less than 20%	10%
20% - 39%	25%
40% - 59%	31%
60% - 79%	27%
More than 80%	2%
Don't know	5%

What percentage of your total IT budget is allocated to legacy system modernization?

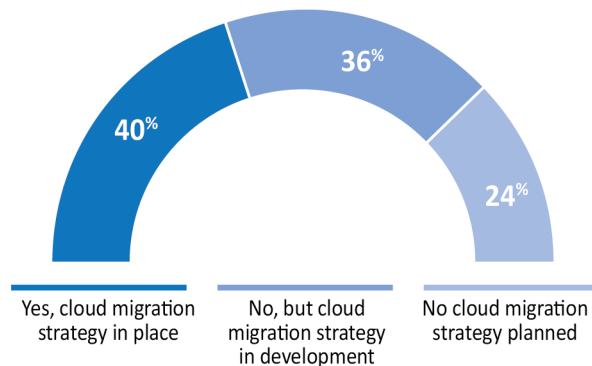| Category	Percentage
1 - 2%	14%
3 - 5%	10%
6 - 10%	22%
More than 10%	39%
Don't know	15%
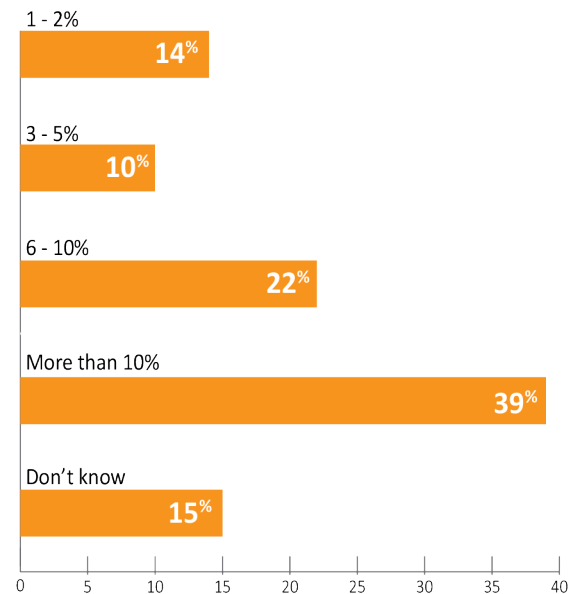
IMPLEMENTATION OF CLOUD-BASED SOLUTIONS

"Cloud first" policies or preferences have been emerging in a number of states. We asked CIOs whether their states had a "cloud first" preference when considering new applications or looking to upgrade existing legacy systems. Over 70% of CIOs indicated that they had "cloud first" policies that were either formal, informal, or in development. This would seem to indicate that the majority of states either have or are planning to have policies that drive applications and systems to a cloud environment. However, some CIOs felt that technology is advancing to the point that the concept itself may no longer be relevant. As one CIO stated, "Cloud first is antiquated. It's artificially restraining. If you're doing what you should be doing you are creating an environment where modern software capabilities transcend that question."

We also asked CIOs whether they had a strategy to migrate applications to the cloud. Three-quarters of CIOs stated that they have developed or are developing cloud migration strategies to migrate legacy systems to the cloud. CIOs stated that the drivers of their cloud migration strategy included cost, security, efficiency and agility.

Does your organization have a strategy to migrate legacy applications to the cloud?

40% — Yes, cloud migration strategy in place
36% — No, but cloud migration strategy in development
24% — No cloud migration strategy planned

Does your organization have a "cloud first" preference when considering new applications or looking to upgrade existing legacy systems?

Yes, formal policy has been implemented
17%

Yes, but informal and on a case-by-case basis
37%

No, but developing formal policy
17%

No, not planning any such preference
27%

Don't know/not applicable
2%

We asked CIOs in last year's survey which categories of services have been or had been planned to be migrated to the cloud. We asked this question again this year, and e-mail/collaboration and office productivity software still lead the pack for cloud migration, but 2016 presents a new trend in open data joining the cloud solution leaders. We also saw a large jump (54% in 2015 to 76% in 2016) in states moving their digital archives to cloud environments. Solutions for disaster recovery and storage, while not currently widespread, are being widely considered for cloud-based solutions.

The models of cloud being used to host the migrations has somewhat shifted over the past year. When asked in 2015 for the first time, CIOs reported that 46% were pursuing a private cloud, followed by 28% seeking a hybrid model. This year, the private cloud model still dominates but the new second option is a public model that is hosted by a third-party entity and openly available. Last year, a larger number of CIOs were pursuing a hybrid model that was a combination of two or more of the other models where this year, it seems that approach has declined in a shift towards the public model. The fairly even distribution across the options indicates that states continue to use a variety of models to meet their cloud migration needs.

What categories of services have you migrated or do you plan to migrate to the cloud?	DONE	ONGOING	PLANNED	TOTAL
Disaster recovery	5%	30%	50%	85%
Citizen relationship management	11%	30%	20%	61%
Digital archives	9%	28%	39%	76%
E-mail and collaboration	32%	38%	21%	91%
Electronic records	0%	36%	34%	70%
Enterprise Resource Planning (e.g., finance, budget, procurement)	5%	37%	21%	63%
Geographic Information Systems	13%	31%	17%	61%
HR / payroll / time and attendance	5%	21%	37%	63%
Identity Management	5%	21%	32%	58%
Imaging	0%	20%	22%	42%
Learning Management Systems	14%	35%	20%	69%
Office productivity (e.g., word processing)	21%	43%	17%	81%
Open data	26%	28%	19%	73%
Program/business applications (e.g. Licensing, Unemployment Insurance, Workers Compensation, etc.)	13%	38%	21%	72%
Project and Portfolio Management	17%	27%	10%	54%
Security services / monitoring	11%	38%	18%	67%
Storage	2%	37%	49%	88%
None of the above	6 %	0%	0%	6%

Where applications have been migrated to the cloud, what percentage of the applications are hosted in each of the following models?	2015	2016
PRIVATE: Hosted by a single organization and made available to other government users	46%	51%
PUBLIC: Hosted by a third-party entity and openly available	15%	25%
COMMUNITY: Used by a specific community of organizations with a shared purpose	11%	9%
HYBRID: A composition of two or more of the above	28%	16%

DATA MANAGEMENT AND ANALYTICS

The 2016 survey included questions surveying Data Management and Governance practices to capture progress achieved thus far while also identifying opportunities and challenges across states. The survey revealed that the overwhelming majority of CIOs consider data governance and management to be a key element of their strategic agendas and operational plans with 58% of CIOs placing data governance and management as a High Priority or Essential element in achieving their goals and objectives.

Within the state CIO's strategic agenda and operational plans, how would you characterize data governance and management?

Low Priority	Medium Priority	High Priority	Essential
11%	31%	42%	16%
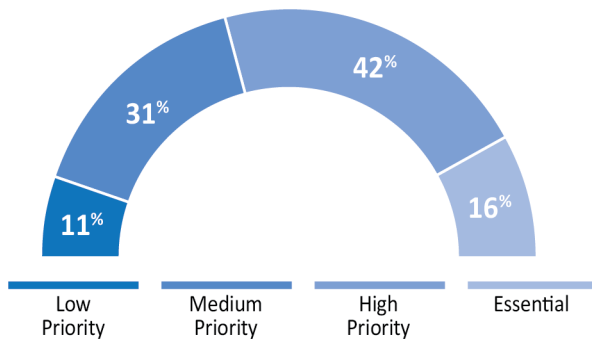
The inclusion and evolution of data management strategies and practices can be ascertained when comparing survey responses over time. In the 2014 CIOs survey, 48% of respondents remarked the need to develop an enterprise data strategy. In 2015, less than 5% of respondents stated that they possessed formal data management policies and practices. The 2016 survey revealed that 46% of respondents now have data governance policies and practices in place, and 23% have implemented a formal data governance organization.

To capture the overall status of Enterprise Data Management from a broader sense, CIOs were asked whether their states had in place the following data management practices and structures. As shown in the table to the right, while most states now have data classification and security standards in place, most are still a long way from implementing a mature Enterprise Data Management function.
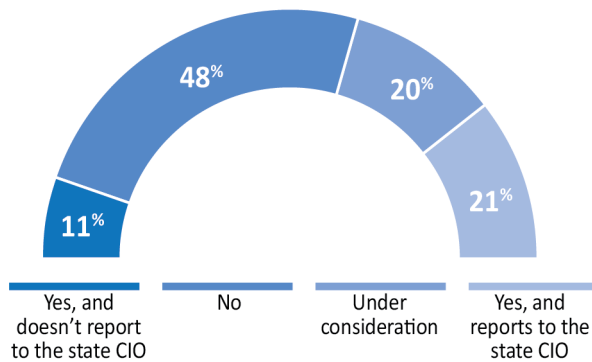
Enterprise Data Management in your state

Have a data stewards network in place	**34%**
Have a data governance policy	**46%**
Have in place standard data modeling best practices and discipline	**11%**
Have data management standards in place for defining a business information model-conceptual, logical, and physical- and we have tools in place to manage these models	**18%**
Have a training strategy in place for the various roles necessary to staff a data management function	**21%**
Have integrated data architecture with overall enterprise architecture	**11%**
Have in place a data and information asset portfolio	**18%**
Have established standards for metadata	**18%**
Have established standards for data classification and security	**71%**
Have strategy in place to deal with unstructured (as well as structured) data	**18%**
Have a strategy in place to deal with large volumes of data	**25%**
Have a well-constructed business case justifying the initial and sustained investment in data management including personnel, training, technologies, and tools	**11%**
Have an established governance organization led by the business with representation from data management, enterprise architecture, information technology, records management, and procurement	**23%**

We asked CIOs specifically about the role of the Chief Data Officer (CDO), and whether their states had created such a position. Only one-third of states have created a CDO position, although another 20% of states are considering creating one. Interestingly, states take different approaches to locating the CDO, with CDOs reporting to the CIO twice as common as those reporting to a different element of the state government.

We also asked CIOs whether a statewide Master Person Initiative was being pursued in their states. Very few states currently have an active Master Person Index, although approximately 25% of states are either currently implementing one or expect such an initiative to begin in the near future. The remaining states are roughly evenly split between having discussions on the topic and having no plans to pursue in the next year.

Does your state have a Chief Data Officer (or equivalent)?

| 48% | 20% |
| 11% | 21% |

| Yes, and doesn't report to the state CIO | No | Under consideration | Yes, and reports to the state CIO |

Does your state have a statewide (or centralized) Master Person Index ("golden record") initiative to facilitate sharing of core citizen records across agency boundaries?

Will not be pursuing this year
28%

Informal discussions; no commitment to action
34%

Formal discussions with agencies about MPI value
13%

Business case completed and fully expect to be initiate MPI project
8%

Project plan is approved, funded and governance defined
4%

Project implementation is underway
9%

Project is stable and sustaining; record updates
4%
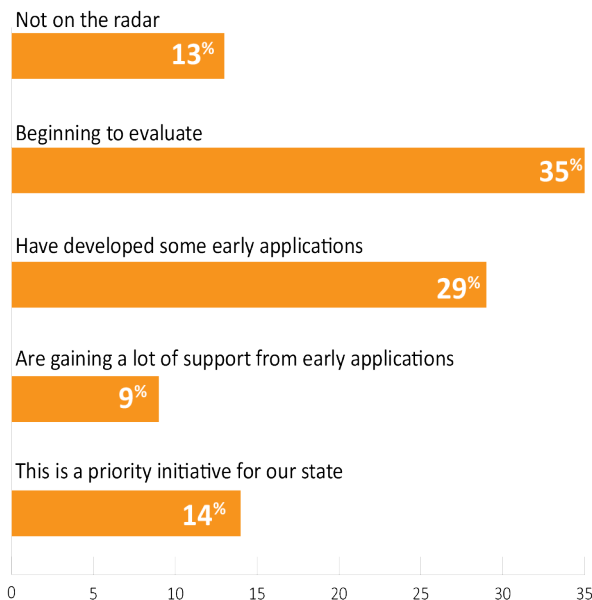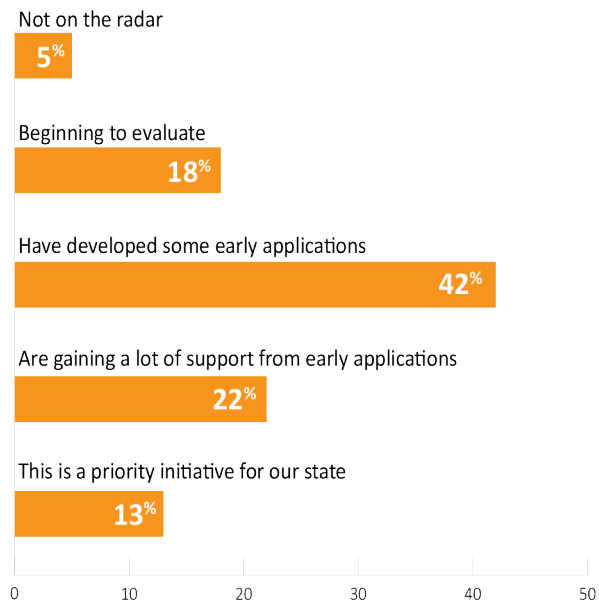
0   5   10   15   20   25   30   35

As data management strategies and practices have evolved over time, the inclusion of data analytics across states has become more apparent and relevant. We asked CIOs about the extent of their deployment of data analytics in their state. Of those responses, 52% indicated their state has deployed some data analytics capabilities in certain agencies, but only 7% categorized their state's maturity and usage in the higher categories as a highly invested state with substantial capabilities in data analytics. However, the overwhelming majority of respondents indicated their state is integrating, or has an interest in the integration of data analytics to develop insights and inform policy decisions. Only 13% indicated having no strategy regarding the use of data analytics to leverage big data in developing business insights to inform policy decisions.

What is the status of any strategies regarding use of data analytics to leverage big data in order to develop business insights and inform policy decisions from the data?

Not on the radar
13%

Beginning to evaluate
35%

Have developed some early applications
29%

Are gaining a lot of support from early applications
9%

This is a priority initiative for our state
14%

0   5   10   15   20   25   30   35

Finally, we specifically asked CIOs to provide a status on any strategy regarding the use of data analytics to combat fraud, waste, and abuse (FWA); 95% of respondents indicated some level of activity. Forty-two percent have already developed some early applications in this area while 18% are at the beginning stages of evaluating opportunities. Only 5% of respondents selected the "Not on the Radar" option regarding the use of data analytics to combat FWA.

What is the status of any strategies regarding use of data analytics to combat fraud, waste, and abuse (FWA)?

Not on the radar
5%

Beginning to evaluate
18%

Have developed some early applications
42%

Are gaining a lot of support from early applications
22%

This is a priority initiative for our state
13%

0   10   20   30   40   50

When asked about the types of programs for which FWA analytics are being used, CIOs overwhelmingly identified the major federally-funded health and human services programs (e.g., Medicaid, TANF, SNAP etc.) as the most common applications. Applications in taxation, child welfare and unemployment insurance were also mentioned.

BENEFITS HHS PROGRAM CHILD HEALTH TANF INSURANCE REVENUE UNEMPLOYMENT PROCUREMENT DEPARTMENT SNAP COMPLIANCE TAX UI HUMAN TAXATION IDENTITY STATE MEDICAID SERVICES
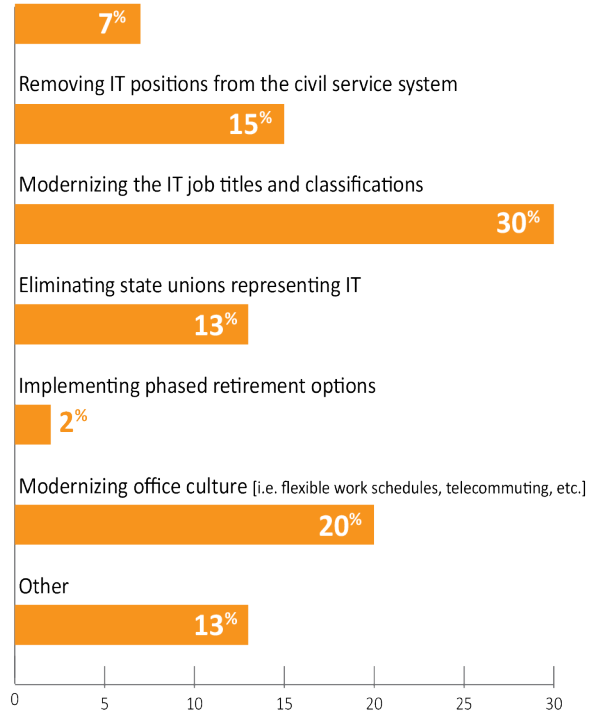
IT WORKFORCE

It has been widely reported that the landscape of today's workforce is changing. Has the so-called "Silver Tsunami" happened? Have millennials really changed the workforce that much (for better or for worse)? And what happens to all of those workers in-between? Indeed, the same questions come into play for the state government workforce, and especially the state IT workforce.

For the first time in many years in this survey, we asked respondents about recruitment, retention, and personnel reform in their state and CIO offices and this was for many reasons. Each year NASCIO releases a State CIO Top 10 list of priorities and initiatives. For the last two years, and for the first time in many years, "human resources/talent management" has made that list. While NASCIO also issued a special workforce report in 2015, we wanted to ask additional in-depth and specific questions to see how states are confronting workforce changes.

In terms of reform options, we asked what single personnel reform could be implemented that would be the most impactful in reforming ("the") state IT workforce? Not surprisingly, "modernizing IT job titles and classifications" ranked highest at 30%. For many years, state CIOs have lamented that a "one size fits all" job classification system in state human resources does not work for IT. When considering that state CIOs consistently rank security as the most challenging job skill for which to recruit and retain talent, and stiff competition from the private sector as another hurdle, it is easy to understand why some IT job titles must be unique, special and different.

What single personnel reform could be implemented that would be the most impactful in reforming your state IT workforce?

Streamlining the hiring process and reducing time to hire
7%

Removing IT positions from the civil service system
15%

Modernizing the IT job titles and classifications
30%

Eliminating state unions representing IT
13%

Implementing phased retirement options
2%

Modernizing office culture [i.e. flexible work schedules, telecommuting, etc.]
20%

Other
13%

CIOs also said that "modernizing office culture [i.e. flexible work schedules, telecommuting, and open office concepts]" would be a highly impactful reform. This is also not surprising as it seems that other sectors are increasingly offering modern office environments and the workforce is demanding it. Other top responses for this question were "eliminating state unions representing IT" and "removing IT positions from the civil service system."

Next, we asked what innovative/out-of-the-box strategies and tactics has your state used in attracting and retaining a highly qualified IT workforce? By a landslide, the two most highly ranked answers here

were, "promoting non-salary benefits" and "call to public service." This is also consistent with the 2015 NASCIO report on state IT workforce where one state CIO told us, "money isn't everything." Truly, state government knows that it cannot compete with the private sector on compensation. Rather, state CIOs are innovating and promoting the experiences that state IT can offer that the private sector cannot.

What innovative/out-of-the-box strategies and tactics has your state used in attracting and retaining a highly qualified IT workforce?

Promoting non-salary benefits like greater stability and diversity of experience	**75%**
Call to public service	**64%**
Public/private internships	**39%**
Sponsoring community awareness events (i.e. hackathons, robot build events, speaking at STEM schools)	**35%**
Building "talent networks"	**31%**
Emphasizing location (i.e. working in state capital)	**29%**
Other	**23%**

Finally, in this section, we asked, has there been a change in your organization culture that has improved or impeded your ability to recruit and retain qualified IT talent? We did get many responses that discussed changes in office culture including flexible schedules, employee recognition programs, increased education and training and modern workspaces. Others discussed a great commitment to diversity in the work place, building up intern programs and expanding mentoring opportunities.

CIOs also discussed how they are "elevating IT" with large cultural changes, telling us things like, "we operate more as peers rather than a traditional top-down environment. We are a team, not a collection of individuals." One CIO said that they are adapting to the "governor's mandate to move at the speed of business and implement transformative IT." Still another CIO reported, "our department's" ability to retain employees has improved due to the new feeling of mission from our enterprise plan. The transition from distributed infrastructure to enterprise services is seen not only as a growth opportunity but also as a challenge that is worth doing."

It is true that state government, especially state IT has faced challenges in the area of workforce recruitment, retention, and development. But, as is clear from the responses we got in this section, states are innovating, states are rising to the challenge and states are attracting the best talent to meet the needs of the citizens they serve. As one CIO told us, "an organization that wants to improve can be exciting."

CONSOLIDATION

Consolidation has been a top ranked priority for state CIOs for a number of years. As we have done in previous surveys, we asked CIOs for a status report on their efforts to consolidate state technology infrastructure and applications. The table below shows this year's results compared to the data from 2014. Because respondents change from year to year and because the infrastructure potentially subject to consolidation also could change, it is difficult to make direct comparisons across years. However, it does appear that consolidation efforts have materially increased in a number of areas, most notably data centers, server, security and telecommunications. These are all areas

where completed consolidation figures have increased in the last two years, with additional consolidation efforts beginning. With the exception of email and telecommunications, consolidation efforts are still not complete for more than 50% of states.

This year we also introduced several additional topics to reflect newer moves to consolidation technologies such as mobile device management and identify and access management. Consolidation efforts are widespread in all these areas, with business intelligence/analytics showing the least maturity, but significant investment.

	2014				2016			
	DONE	ONGOING	PLANNED	DK/DNA	DONE	ONGOING	PLANNED	DK/DNA
Backup/disaster recovery	39%	47%	12%	2%	32%	52%	13%	3%
Business applications	17%	40%	13%	31%	15%	44%	13%	25%
Content management	18%	30%	26%	26%	21%	42%	13%	26%
Data centers	52%	40%	4%	4%	42%	47%	11%	0%
Desktop support	33%	31%	8%	29%	31%	37%	20%	12%
Email	65%	27%	8%	0%	59%	35%	6%	0%
Imaging	16%	35%	10%	39%	19%	42%	12%	27%
Security	44%	44%	6%	6%	31%	56%	9%	4%
Servers	43%	47%	4%	6%	31%	65%	4%	0%
Staff	33%	29%	4%	35%	29%	33%	15%	24%
Storage	41%	43%	4%	12%	35%	54%	11%	0%
Telecom	67%	27%	4%	2%	57%	35%	7%	0%
Helpdesk	NA	NA	NA	NA	38%	28%	17%	17%
Mobile device management	NA	NA	NA	NA	37%	30%	20%	13%
Identity and Access Management	NA	NA	NA	NA	30%	39%	26%	5%
Data Warehouse/ BI/ Analytics	NA	NA	NA	NA	8%	40%	30%	22%
Project Management Office	NA	NA	NA	NA	39%	30%	17%	15%
State Portal	NA	NA	NA	NA	48%	36%	9%	7%

PROCUREMENT

Procurement has been a top area of concern for CIOs in almost every year of the state CIO survey. CIOs have clearly been divided in past years on the effectiveness of IT procurement processes. The shift to a services-centric acquisition approach for IT has added to the disruption. Several CIOs pointed to these challenges when assessing the effectiveness of their IT procurement processes:

"Our challenge has been getting businesses to open themselves up to the possibilities and understand outcomes rather than inputs."

"We have had to transform from asking what the solution is to asking what the problem is."

This split continued into this year's survey. We specifically asked CIOs this year to rate the effectiveness of negotiation processes in their states, both during the proposal process and after the proposal submission but before the contract award. Approximately one-in-ten states do not conduct negotiations during the proposal process, but less than five percent of states do not negotiate after the proposal submission and before the contract award. Of the states that do conduct negotiations, approximately 50% of CIOs felt that negotiations were somewhat or highly effective, whether conducted during the proposal development and evaluation process or prior to the contract award. Less than ten percent of respondents found negotiations to be clearly ineffective.

When asked what state IT procurement reforms have been most effective in their states, adding flexibility to terms and conditions seemed to be a leader. Additional themes included centralization of IT procurement under a single authority, use of cooperative or multiple award purchasing agreements, and improved communication and interaction with the vendor community.
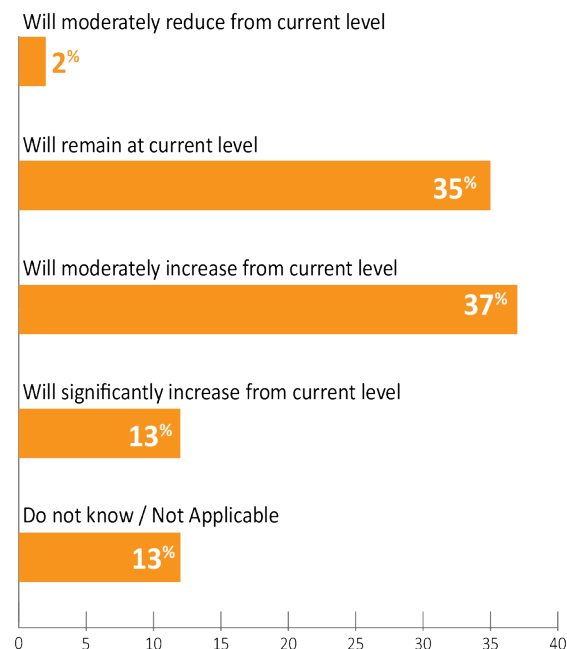
CROSS-JURISDICTIONAL COLLABORATION

As previous NASCIO research has highlighted, there are mutual advantages for states and local governments to "join up" including improved efficiencies, effectiveness and savings. Local governments continue to experience significant fiscal stress, even more than states. We can anticipate more cross-jurisdictional collaboration as local governments examine and rationalize their portfolio of IT services in response to budgetary constraints. This year's annual survey presents some interesting results regarding cross-jurisdictional business and service relationships.

Based on responses to the survey, clearly state CIOs are anticipating greater cross-jurisdictional service opportunities with local governments in the future. Half the states plan to increase their budgets for cross-jurisdictional collaboration. About one-third will sustain their current budget levels. Approximately 85% of states will sustain or increase their budgets for such partnering. Only about 2% will reduce their budgets. Overall, states are clearly planning for sustained or increased levels of commitment to cross-jurisdictional collaboration.

Over the next five years, how will the proportion of your agency's technology budget devoted to cross-jurisdictional collaboration change?

Will moderately reduce from current level
2%

Will remain at current level
35%

Will moderately increase from current level
37%

Will significantly increase from current level
13%

Do not know / Not Applicable
13%

Compared with the same question from the 2013 State CIO Survey there is a demonstrated increase in the level of IT services states are providing to local government. Moderate escalation has occurred with co-location, email and office productivity, GIS, portal and website hosting, mobile apps and ERP. In these key categories it's obvious local partners can leverage state government economies of scale and reduce their costs. In several IT service categories, we see a slight increase and expansion in new offerings to local governments. These include network services, data center hosting, security and cloud solutions.

As part of the cross-jurisdictional services portfolio, what services are you offering to local governments?	2013	2016
Network services	63%	66%
Data center hosting	61%	64%
Co-location	41%	60%
Email/Office productivity	47%	60%
GIS	47%	60%
Security	51%	54%
Cloud solutions/hosting	41%	48%
Portal/Website hosting	29%	40%
Storage and backup	28%	32%
Telephone	45%	32%
Video conferencing	26%	30%
IT training	35%	24%
Mobile apps	12%	22%
ERP	12%	18%
Applications development/support	24%	16%
Business Intelligence/Business Analytics	14%	14%
Digital archiving and preservation	10%	10%
Imaging	10%	10%
Records management	6%	8%

With the significant risks to public sector entities, we anticipate future growth in cybersecurity collaboration. If not outright use of services, then at least greater coordination and interaction to protect critical infrastructure. An important illustration of this collaboration is the need for cyber disruption response planning. The responses also show some unexplained reductions in traditional services that states are providing to local governments. Notably are telephony, IT training, and application development and support.

MOBILITY

Mobile devices and applications have continued to be a high priority for a majority of CIOs. We have asked questions relating to mobility since 2013, and have found that mobile initiatives have been moving higher in importance and visibility across state governments.

In our 2016 survey, we've again asked CIOs to report on the status of mobile devices and applications projects. A combined 53% of respondents report that such projects are in either the "essential" or "high priority" category. This is almost unchanged from the total tallied by the "essential" and "high priority" categories in 2015.

| Within the state CIO's strategic agenda and IT operational plans, how would you characterize mobile devices and applications?	2015	2016
LOW PRIORITY	9%	13%
MEDIUM PRIORITY	40%	32%
HIGH PRIORITY	32%	33%
ESSENTIAL	19%	20%
DO NOT KNOW / DOES NOT APPLY (DK/DNA)	0%	2%

This year, we also asked CIOs what percentage of their current applications were mobile-ready. As shown in the table below, very few states have more than forty percent of their applications mobile-ready.

What percentage of your current applications are mobile ready?

- Less than 20%: 65%
- 20% - 39%: 25%
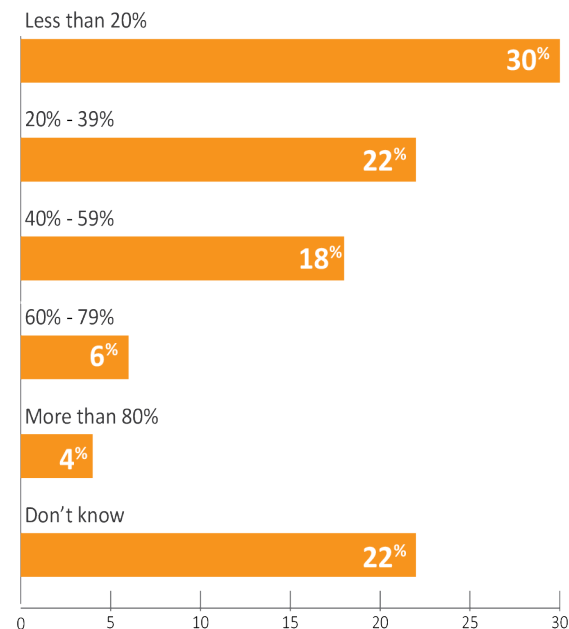- 40% - 59%: 4%
- 60% - 79%: 4%
- More than 80%: 2%
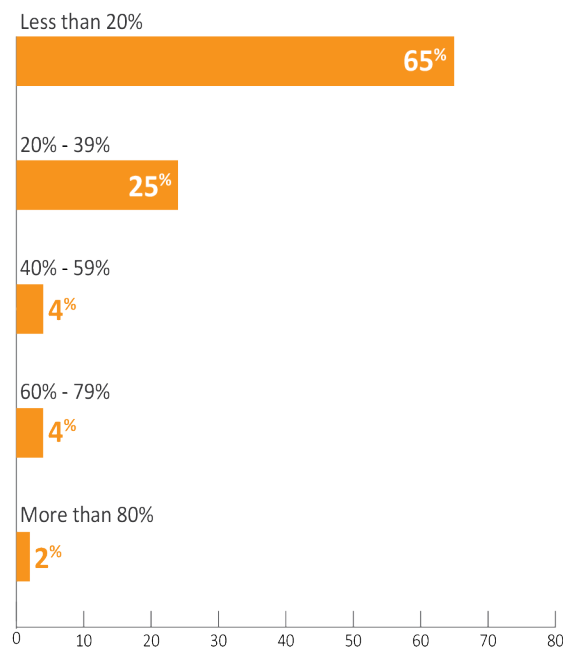
We also asked CIOs how many of their users (both state employers and external) were utilizing their mobile applications. As the tables below show, mobile application penetration is still quite low for both populations, with just 10% of CIOs reporting that greater than 60% of their employees and external users were using mobile applications. Interestingly, almost one-quarter of CIOs do not know the percentage of external users that are utilizing mobile applications.

What percentage of your state employees are utilizing mobile applications?

- Less than 20%: 50%
- 20% - 39%: 23%
- 40% - 59%: 8%
- 60% - 79%: 2%
- More than 80%: 8%
- Don't know: 9%
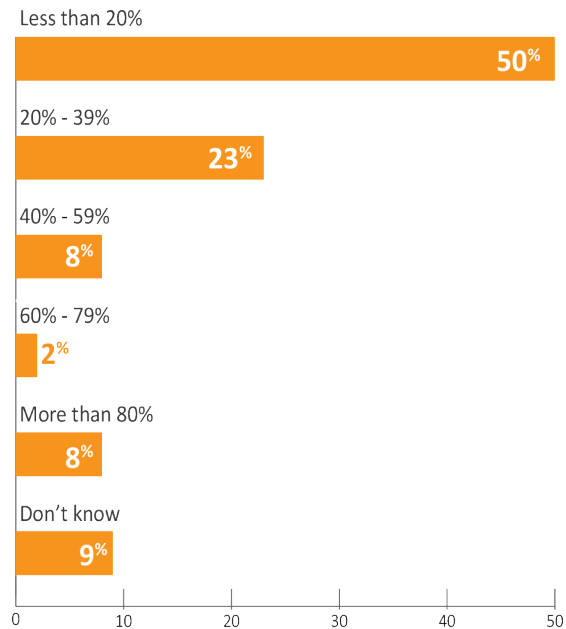
What percentage of your external users are utilizing mobile applications?

- Less than 20%: 30%
- 20% - 39%: 22%
- 40% - 59%: 18%
- 60% - 79%: 6%
- More than 80%: 4%
- Don't know: 22%

CYBERSECURITY

State governments face significant business risks and cybersecurity continues to be a top priority for state CIOs. Without hesitation, we included the topic in this year's survey and asked CIOs about their cyber programs, preparedness, and workforce. First, we asked about the current status of cybersecurity programs and environments in state governments. Progress is evident and there are a few notable findings when compared to the 2015 survey.

First, 71% of respondents reported that they have developed a cybersecurity disruption response plan, as compared to 52% in 2015. This is consistent with NASCIO's "Cyber Disruption Planning Guide," that urges state governments to view cyber attacks as more than cyber incidents and prepare for larger magnitude events. Also of note is that 94% of respondents reported that they have adopted a cybersecurity framework based on national standards and guidelines, up from 80% in 2015.

Please characterize the current status of the cybersecurity program and environment in state government.

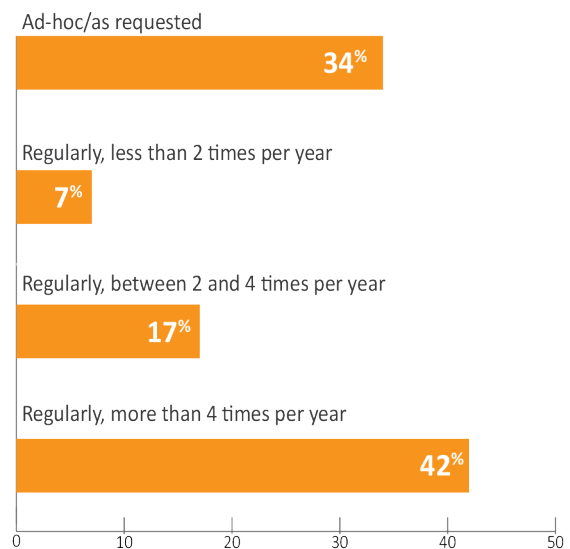|	
Adopted a cybersecurity strategic plan	**72%**
Created a culture of information security in your state government	**77%**
Adopted a cybersecurity framework, based on national standards and guidelines	**94%**
Acquired and implemented continuous vulnerability and monitoring capabilities	**83%**
Documented the effectiveness of your cybersecurity program with metrics and testing	**64%**
Developed security awareness training for workers and contractors	**85%**
Developed a cybersecurity disruption response plan	**72%**
Obtained cyber insurance	**26%**

Based on both survey evidence and anecdotes, there is certainly a cybersecurity talent crisis in state government. State CIOs desire to grow both the number, skills and scope of responsibilities of these IT professionals. We asked CIOs about the percentage of state IT workforce who are dedicated cybersecurity professionals. The overwhelming majority of respondents (83%) said 1-2%. We know that state CIOs face a series of challenges when it comes to recruiting and retaining qualified cybersecurity talent and this data supports this assertion.

What percentage of your state's IT workforce are dedicated cybersecurity professionals?

- 83% — 1-2%
- 13% — 3-5%
- >2% — 6-10%
- 0%
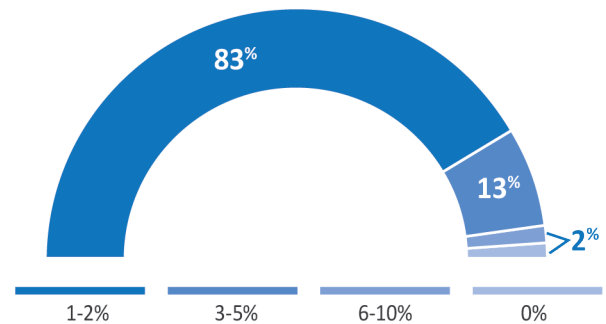
Communicating the security posture and business risks associated with cybersecurity is critical in state government. CIOs were asked how often they communicate with legislators and other senior state officials on levels of business risk and their state's abilities to protect against external cyber attacks. Most answered "regularly, more than 5 times per year" (42%) and "ad-hoc / as requested" (34%). Although this level of interaction is growing, it is clearly lacking given the nature of the risks.

How often do you communicate with legislators and other senior state officials on levels of business risk and your state's abilities to protect against external cyber attacks?

- Ad-hoc/as requested — **34%**
- Regularly, less than 2 times per year — **7%**
- Regularly, between 2 and 4 times per year — **17%**
- Regularly, more than 4 times per year — **42%**

PRIVACY AND DATA PROTECTION

With significant increases in cybersecurity threats and the risks to states, the focus on data loss and potential privacy impacts are garnering much more attention from governors, legislators and other public officials. State leaders now recognize they must uphold the public trust by protecting the privacy of citizen data. In an important shift, 65% of the respondents say recent cyber incidents have changed the way they approach oversight of privacy issues. One-third say recent incidents have not changed the way the state handles privacy.

Large private sector companies have long recognized the need to address privacy concerns of their customers with an executive responsible for oversight. However, when it comes to a dedicated, executive-level Chief Privacy Officer, they are still rare in state government with only 11% claiming to have a CPO. However, another 12% have someone working on privacy as part of their job at the executive level. About half claimed to have someone at the agency level dedicated to privacy as their job or part of their job. Slightly more than a quarter of respondents claimed to have no one dedicated to privacy issues.

Does your state have a Chief Privacy Officer?

We have an enterprise executive-level Chief Privacy Officer (>75% of time spent is managing privacy)
11%

We have someone who handles privacy as part of their official job at the executive level
12%

We have privacy officers at the department or agency level but there is no enterprise privacy role
15%

We have individuals who handle privacy as part of their official job at the department or agency level
**36%**

We have no one dedicated to privacy issues
26%

0   5   10   15   20   25   30   35   40

Only 25% of respondents say they have a formal process for embedding privacy into projects with another 64% considering privacy as needed. Twelve percent have no process. This is concerning and will need to be addressed to advance the privacy protections citizens expect.

Do you have a process for embedding privacy into your projects?

64%

25%

12%

Yes, we have a formal process | No formal process, but privacy is considered as needed | No process
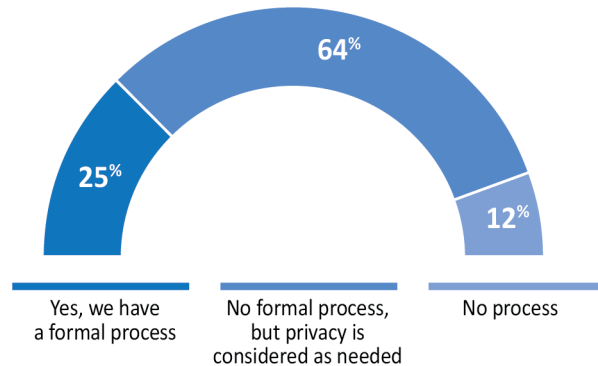
When State CIOs were asked about the top challenge related to ensuring privacy oversight and compliance, many answers were related to a lack of enterprise policy across agencies. There was concern about a lack of awareness throughout the agencies on the importance of privacy as well as feeling that privacy was not considered as critical as security.

As for reforms needed in the privacy arena, the suggestions were focused on two themes: respondents articulated a need for dedicated privacy professionals or a dedicated Chief Privacy Officer, and; the need for a state-wide privacy framework that streamlines privacy laws and takes into account different types of data while increasing awareness.

INTERNET OF THINGS

The Internet of Things (IoT) continues to attract a great deal of public and media attention and is generating discussion in the state and local government technology space. We asked CIOs again this year about their plans for IoT. Comparing this year's results to 2015, it appears that most activity is still informal, but IoT is becoming more recognized as a topic worthy of policy and planning. It's positive that state CIOs are having formal discussions, however addressing IoT in the strategic IT plan, with an associated roadmap and supporting policies, will be necessary to create value and reduce potential risks.

To what extent is the IoT on your agenda?	2015	2016
No discussion of IoT at this time	23%	13%
Still investigating IoT in state government with informal discussions	53%	56%
Formal discussions on IoT applications, data collection, and security	18%	32%
IoT referenced in the state IT strategic plan	6%	9%
Developed IoT road map to guide adoption and deployment	0%	4%
Adopted IoT policies, data framework, and security controls	0%	2%
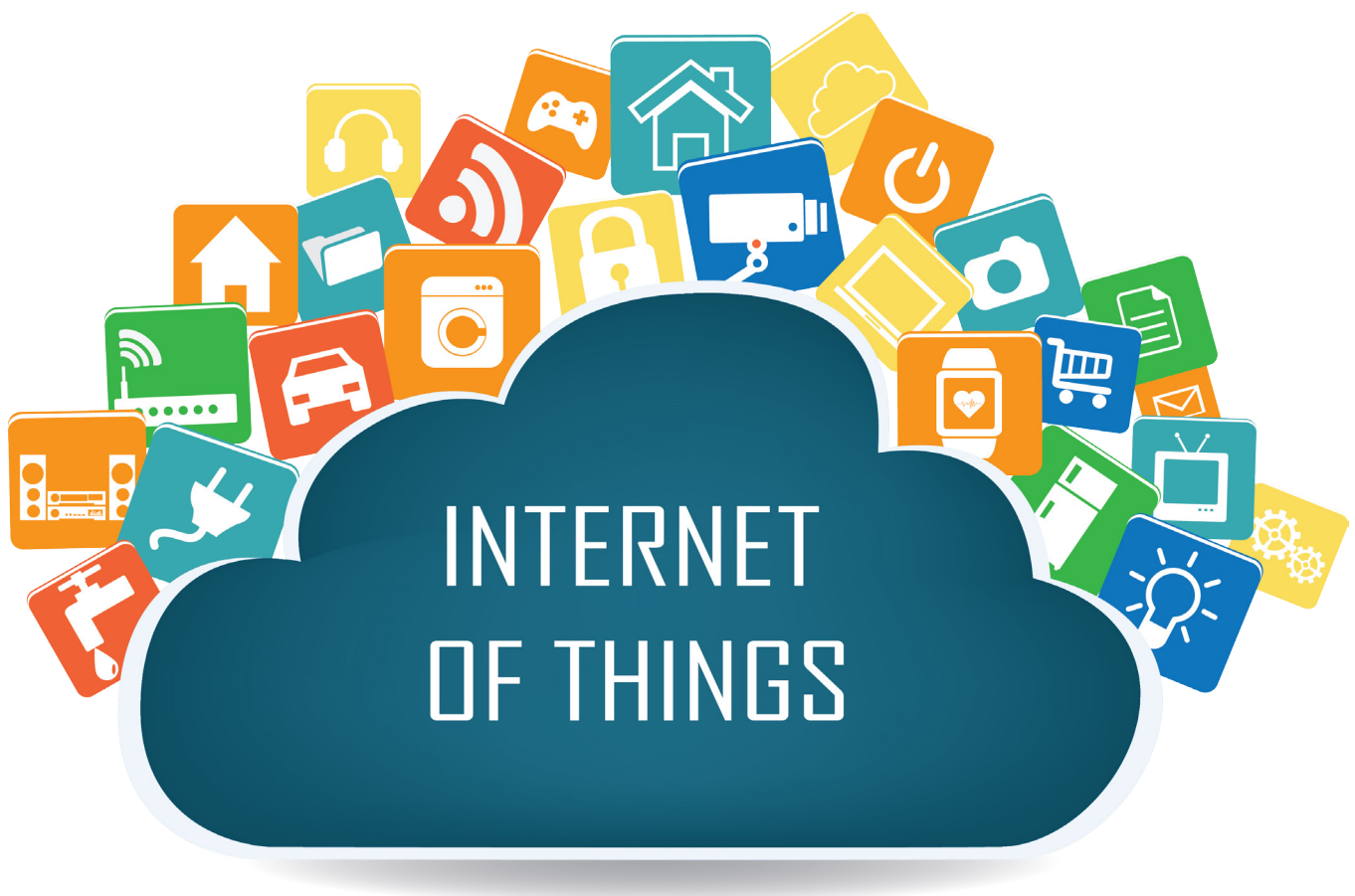
CONCLUSION

In this year's survey CIOs again provided us with insight into a diverse array of topics, from business models to human capital management and data analytics. In each area, CIOs are adapting to changing circumstances and expectations. This requires agility to respond quickly to the unexpected, but also the strategic vision to anticipate and to plan for a future that cannot be easily predicted. As CIOs view the evolving state IT and business landscape, they are adapting to changing economic circumstances, to innovations in cloud-based software and service delivery, to ever-changing security and privacy challenges, and to the expectations of a millennial workforce.

CIOs have shared with us this year some of the ways in which they are leading innovation in their states, and continuous adaptation and innovation will be critical as states look to address new and changing opportunities and challenges.

LIST OF STATES AND TERRITORIES PARTICIPATING IN THE SURVEY

STATE OF ALABAMA
Joanne Hale, PhD
Secretary of Information
Technology

STATE OF ALASKA
Jim Steele
Director and Chief Information
Officer

STATE OF ARIZONA
Morgan Reed
State Chief Information Officer

STATE OF ARKANSAS
Mark Myers
Director and Chief Technology
Officer

STATE OF CALIFORNIA
Amy Tong
State Chief Information Officer

STATE OF COLORADO
Suma Nallapati
Secretary of Technology and
Chief Information Officer

STATE OF CONNECTICUT
Mark Raymond
Chief Information Officer

STATE OF DELAWARE
James Collins
Chief Information Officer

STATE OF FLORIDA
Jason Allison
Executive Director and
Chief Information Officer

STATE OF GEORGIA
Calvin Rhodes
Executive Director and State
Chief Information Officer

STATE OF HAWAI'I
Todd Nacapuy
Chief Information Officer

STATE OF ILLINOIS
Hardik Bhatt
Secretary and Chief Information
Officer

STATE OF IOWA
Robert von Wolffradt
Director and Chief Information
Officer

STATE OF KANSAS
Phil Wittmer

Chief Information Technology
Officer

**COMMONWEALTH OF
KENTUCKY**
Jim Barnhart
Acting Chief Information Officer

STATE OF LOUISIANA
Richard "Dickie" Howze
State Chief Information Officer

STATE OF MAINE
James Smith
Chief Information Officer

STATE OF MARYLAND
David Garcia
Secretary of Information
Technology

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To obtain copies of this report and the survey questionnaire, go to any of the websites listed below.