Taming ‘big data’ complexity through automation

The impact of big data on an organization will be explosive as the internet of things (IoT) matures. Managing this explosion will not be possible without intelligent data automation.

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‘Big data’ is often confused with ‘lots of data’. However, big data has many aspects – different varieties of data traveling at different velocities, with users having different needs for the speed of the results of data analysis to be fed to them. Dirty data impacts the veracity of the data, and getting a data platform wrong will adversely impact the value of the results to the organization.

There is a strong need to ensure that individuals can access data in a manner that empowers them with the information they need to make better decisions. However, no organization can expect all of its employees, partners, suppliers, customers and other stakeholders to become ‘data intelligent’. Data automation is required to enable the complexities of big data to be hidden from the individual, while providing them with the data accessibility and insights they want.
Executive Summary

Taming ‘big data’ complexity through automation

As big data and the internet of things (IoT) cause massive growth in the amount of data needing to be stored and managed, organizations are struggling to ensure that they are getting the value they need from the data. Automation is the key to unlocking the value: choosing the right tools should be a priority.

<table>
<thead>
<tr>
<th>‘Big data’ is not the same as ‘a lot of data’</th>
<th>Those who have large, formalized databases do not necessarily have a big data problem. True big data issues arise where there are multiple different sources of data that need to be brought together so that meaningful analysis and reporting can be carried out. Unfortunately, such data can be in different formats (relational database, simple file structures, images) and may need transforming into a normalized format before it can be used.</th>
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<tbody>
<tr>
<td>The internet of things (IoT) and internet of everything (IoE) are poised to make data issues far worse</td>
<td>The IoT and IoE threaten to introduce thousands to millions of devices into an organization’s networks, each generating data of its own variety, at its own volume and velocity. Ensuring that this data is dealt with effectively will require accurate and effective data discovery along with extraction, transform and load actions, as well as automated data movement. Attempting to deal with the IoT/IoE without automation will be doomed to failure.</td>
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<td>Data automation is becoming a necessity – not a ‘nice to have’</td>
<td>Unfortunately, humans make mistakes. Expecting manual activities on large estates of disparate and dispersed data to be error free is nonsense. Errors will occur; time will be wasted. Managing the sheer volume of data produced by the IoT/IoE will require massive manual intervention if it is to be processed in a timely fashion. By using data automation, errors can be minimized and organizations can achieve the scalability they need to fulfill big data processing demands. The bottom line being - more actions can be carried out and data accessibility for all users improved</td>
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<td>Data accessibility should be the prime objective</td>
<td>Users require access to the data they need to make better decisions. This will help them as an individual and as part of a team, that is part of a department, that is, in itself, part of the organization. By making data accessible from the bottom to the top of an organization, everyone gains. Decisions will be more accurate and outcomes more valuable. Individuals can concentrate on being ‘data savvy’ rather than ‘data intelligent’ – the complexities of the underlying data sources and structures can be hidden from the users.</td>
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<td>Providing template and function libraries gives greater power to users</td>
<td>Out-of-the-box templates, along with pre-built, standardized requests, can provide users with access to easy means of dealing with complex data actions. Enabling power users within an organization to create and share additional templates and functions, then allows the organization’s domain expertise to be improved through data automation. Drag and drop user interfaces can make life easier for non-power users wanting to leverage existing templates and functions as well as create their own.</td>
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<tr>
<td>Data automation provides the means for improving internal and external processes</td>
<td>By ensuring that data is accessible, securely available and easily movable, an organization can optimize its business processes. This is not just looking at internal processes, but also along the organization’s value chain of suppliers, customers, contractors, partners, shareholders and others. This means that an organization can be more responsive; can be more flexible in its sector and can be better at predicting future states in its markets. Data automation helps drive positive movement in an organization’s bottom line.</td>
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Conclusions

Data automation is growing as a need for any organization. Faced with growing data volumes in multiple varieties, with the IoT/IoE driving the stream velocity of data. While users require fast availability of data for analysis, the true value of data can only be extracted and managed through the use of intelligent and advanced data automation. Instead of a search for the mythical ‘data scientist’, organizations should focus on data accessibility for all. Democratization of data accessibility will drive an organization’s decision-making capabilities, and help in streamlining its internal and external processes. It will enable intellectual property to be more accurately discovered, stored and distributed. It will build an organization’s wisdom, enabling it to be far more competitive within its markets. Neglecting data automation will have strong adverse impacts on an organization’s capabilities.
Big Data, the IoT and the IoE

To many, the term ‘big data’ is still looked at in terms of volume. Surely, if an organization has to deal with several petabytes of data, it has a big data problem? Actually, it has ‘a lot of data’ problem – big data is far more than just volume.

Organizations also have to consider the following ‘V’s to fully understand what is going to happen to their data in the coming years.

» **Variety** – data has to be dealt with in all its different types – organized data held in a standard relational database is no longer the only consideration. Image, voice, video as well as office documents, web log files and other less structured data has to be dealt with.

» **Velocity** – how fast is the incoming data being presented and how fast are the downstream needs, whether this is for a person or a machine in the process?

» **Veracity** – How clean, accurate and ‘real’ is the data?

» **Value** – Just why is the data being dealt with anyway – what is the value of the end result?

The volume of data being dealt with is also a consideration, but it is only in the context of the other ‘V’s where big data approaches really matter.

The problem is that alongside the exponential growth of formal data, the growing ubiquity of technology in all of our daily lives has led to massive growth in less structured data. Now, the internet of things (IoT) and the internet of everything (IoE) is poised to make today’s data growth rates look like a mere blip.

The IoT can be seen as how devices (both new intelligent devices and existing, less intelligent ones) are now being attached to an organization’s standard IT platform to provide greater control and business value. Here, we see security systems (cameras, biometric devices, sensors) being run via Ethernet to central monitoring systems. Production lines are having their sensors, actuators and other devices attached to the network; allowing more standardized levels of control to be applied to systems than have been available through prior, more proprietary, approaches. We also see the need for all these ‘new’ devices to provide data into, and use data from, existing data stores from more standard systems, including enterprise applications and external data feeds, such as Dun & Bradstreet or LexisNexis.

The key here is that all these IoT devices would be under the organization’s direct control – the organization owns every device.

However, to gain the optimum value from connected devices, organizations need to look beyond their own environments at what is available along the value chain of suppliers and customers.

It is likely that many participants in the value chain will have their own IoT, with devices creating data that may or may not be of value to your organization. For example, a supplier may have devices in its warehouse, such as radio frequency identification (RFID) tagging that enables your organization to know how many items of a certain sort it has in stock. The logistics company that is carrying goods between the supplier and your organization may have global positioning system (GPS) trackers in all of its vehicles, enabling your organization to track exactly where a delivery is in real time. Even individual consumer customers will have their own IoT – wearables talking to their smartphone and from there to the rest of the world, opening up opportunities to use opt-in information from these systems to optimize the customer’s experience.

These devices are not under your direct control, and constitute the internet of everything (IoE) – devices where you may have access to the data, but not
Ensuring the Value of data

“The one ‘V’ that seems to escape most organization’s attention is ‘Value’ – just why is the data being analyzed at all? Quocirca often finds that an organization will have a desired outcome, and will ask for just enough data and analysis to meet that objective. However, the approach should be one where ideas are posited and checked by being able to collate and analyze enough data to show whether that position is right – or wrong.”

Dealing with data from the IoT and IoE is going to stress many areas of an organization’s IT. Each device can be pumping out small packets of data on a high frequency basis. Allowing every device to talk directly to a central point will overwhelm the network’s bandwidth capacity – even if you have Gigabit networks end-to-end.

The variety of formats that the data will be presented in – such as machine data with comma, tab or space delimiters – will need addressing. Some will be in relatively proprietary formats, or in formats that have been standardized for other, older networks and automation systems.

It will be impossible to deal with the IoT/IoE without solid big data systems – and these systems will need intelligent data automation, to ensure that they work within the physical constraints of an organization’s IT.

What is the ‘Value’ of data?

The one ‘V’ that seems to escape most organization’s attention is ‘Value’ – just why is the data being analyzed at all? Quocirca often finds that an organization will have a desired outcome, and will ask for just enough data and analysis to meet that objective. However, the approach should be one where ideas are posited and checked by being able to collate and analyze enough data to show whether that position is right – or wrong.

This is not something that IT can do – the IT teams are not business analysts, and are not positioned to garner any insights in business data that will be of direct and immediate use to those in the lines of business. Neither should value be predicated on the business savvy data scientists – there are too few of these around to be the guardians of an organization’s data insights.

The whole idea of value is in democratizing the capability to view and analyze data – and this requires a team approach to the problem.

An organization is not a single entity – it is a group of mixed individuals. Some of these individuals are directly employed and some will be contractors and consultants. Some will be externals brought in on a temporary basis for their domain expertise or because they work with an important partner. All these individuals then work together in teams; these teams

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**Figure 1: The IoT and the IoE**

- **IoT**: Devices under your control
  - Limited device control; only data access possible.
  - Possible data transfers:
    - Comma, tab, space delimited
    - Database (e.g. dBase, MySQL)
    - FTP, API, database connector
    - Batch/realtime

- **IoE**: Devices outside of your organization’s direct control
  - Full device control; two-way actions possible
  - Possible data transfers:
    - Comma, tab, space delimited
    - Database (e.g. dBase, MySQL)
    - Proprietary (digital/analog)
    - FTP, API, database connector
    - Batch/realtime
    - Scripting
    - Full programming (generally via API)

The Internet of Things (IoT) is just a small subset of the Internet of Everything (IoE).
are part of a department, which is then part of the overall division or full organization. Each has a slightly different need in what it gets from the data: the overall requirement is to ensure that these needs are pulled together in a way that adds value along the whole chain (see Figure 2).

Through putting in place the right tools that enable easy access to disparate and dispersed data sources in a manner where individuals can input their findings into the chain, everyone can gain.

Individuals feel more empowered; feel that they are contributing more to the overall organization – and the organization will find that its bottom line is impacted in the correct way with higher revenues, margins and profits.

It all sounds so simple – but underpinning it is a need for a solid data-centric platform that hides all the complexity from the individual. Anything that requires technical scripting; a full knowledge of data schemas; the technicalities of data extraction, transformation and loading (ETL) or other data- or IT-centric capabilities will not democratize the use of data analytics. It will remain in the hands of the few – and then the whole future of the organization lies with key personnel, rather than it being spread across the skills, knowledge and capability for insights of the entire workforce.

Then, analysis systems were brought through which enabled organizations to look at this data in near-real time. This way, they could gain insights as to what was happening to the organization at a point in time, which was close enough to now, be able to make decisions that could impact the direction of the business in the short term. However, unless sufficient data was to hand, the reports could be misleading, and often resulted in bad decisions being made.

Increasingly, new types of data were becoming important. Not everything was being stored in a relational database – valuable information was being held in office documents and information on the Internet gave insights into market conditions and the capabilities of competitors, which could not easily be seen through purely formal internal data sources. The business wanted better predictive capabilities – yet this massive growth in data volumes along with the variety of data types began to count against this ever happening.
Then the capability to deal with big data came along. The use of Hadoop as a non-persistent data store, utilising its MapReduce capabilities to filter large amounts of less structured data, along with the use of file-based non-relational databases opened up the data world to new ways of doing things.

The problem of multiple data stores

“The problem was that this also provided more issues – Hadoop and NoSQL did not replace anything that had gone before. The world was becoming a mix of relational, non-relational and data filtering systems, with multiple different means of analyzing and reporting on the data that was held across the three data stores (Hadoop, a relational store, and a non-relational one).”

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Automating the movement of data, so that it is in the right place for analysis and reporting to take place, needs intelligent orchestration that understands the data and how best to place it where it needs to be. Automating the movement of data provides the ideal IT environment for the business tasks and processes to be based on. Faster decisions can be made against more complete data sets, enabling a more responsive organization that makes fewer mistakes. Mobile users can access whole data sets while on the move and still make decisions without the need for a desk-based computer.

Let’s then take this forward to the future: the IoT/IoE brings in hundreds of millions of newly connected devices to the network, all presenting large numbers of small packets of data that need to be dealt with. Natural interfaces mean that speech and visual cue recognition are required alongside this data influx. Inputs from interfaces have to be analyzed, such that actions can be triggered as to what needs to be done with the data concerned.

So, orchestrating data is a key part of the mix. Choosing the right tools to make this possible is an imperative – if a company’s competitors make the right choices, while it stays with what it has, its competitive position will be poor.

Figure 3: The increasing volumes and complexity of data systems

The new generation of the human/machine interface

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Orchestration of data systems

To gain the most of the data available, there are several steps that need to happen.

» **Understanding the business issue** – The application of technology should never be just for technology’s sake. The business needs to be able to articulate what it is trying to do: the technology should enable the requisite outcome in the best manner possible.

» **Identify or create a suitable business process to solve the business need** - Businesses run on processes, and these consist of a set of tasks. Building processes from tasks enables flexibility: only those tasks that are impacted need to be changed as the business requires – not the whole task.

» **Identifying the relevant data** – The data needed to support the tasks and processes may be highly dispersed. The data may be easily available or may be harder to get to and extract. It may be internal or external. However, the data must be identified.

» **Drag and drop capabilities** – Users must have no need to understand data schemas. Instead, systems must support simple drag and drop capabilities, along with either default accurate data matching (e.g. ‘Customer’ in data source 1 is equivalent to ‘Customer_ID’ in data source 2), or through intelligent advice on what is likely to be right (e.g. “Data source 1 has a field that has ‘John Smith’ in it; data source 2 has one that has ‘Smith, John’ in it. Are these two fields the same?”).

» **Maintaining system security across different systems** – Data needs to be dealt with in a secure manner. Therefore, knowledge of the original security applied to it is required, as the data is made accessible to other systems. This may be by individual or by role. It may also be that security of data is required by context – for example, is a user coming in from a device attached to a public Wi-Fi access point, and should they not be able to see certain information if this is the case?

» **Data cleansing** – Just because data exists does not mean that it is real, accurate or required. Inventory counts may not have been updated on computer systems. You may have a customer name of John Smith, when it should have gone down in the system as Jon Smith. Ensuring that the data analysis tools provide the most value to you and your business is predicated upon having ‘clean’ data. Use polling to see if you can clean some (are those two John/Jon Smith records both tied to the same address with the same telephone number?). Use external systems – for example, the UK Post Office provides databases of names and addresses tied to postcodes that are used by professional data cleansing bureaux such as UK Changes.

» **Extracting and aggregating the data in a form suitable for analysis and reporting** - Once there is clean, accurate data, it then has to be put into a form that is suitable for overall analysis. In many cases, a knowledge of the application overlying the data will allow a schema to be automatically understood, and for data to be far more easily accessed. A ‘data lake’ is not about forcing everything into a single, massive database – it needs the capability to make the most of tools that allow for data filtering and rationalization, such as through the use of MapReduce and Hadoop (or Hadoop-style) clusters. To create a normalized data structure, extract, transform and load (ETL) approaches are needed – but these need to be automated wherever possible to remove error-prone and time-consuming human intervention. Certain data actions can be automated through the use of intelligent scripts – and modern tools can often create these scripts automatically, without the need for IT, database specialists or data scientists to be involved.
» Error monitoring and reporting - As the data automation process progresses, full auditing is required at all stages. As soon as an error is noted, the system should be able to roll back to a known position and try again, or to roll back and raise an exception for either another system or for a human to deal with. To this end, the system should be able to carry out its own root cause identification (RCI) of any problem, so as to make rectification and resumption of service as rapid as possible.

» Analyzing and reporting data to create information and knowledge – Once the data is in a form that can be understood by an analysis engine, then the analysis can be carried out. In the majority of cases, this will be to see if a stance posited can be proved. In a few others, it will be to see if there are patterns in the data that have not been seen before, and then to see if using these findings can add value to the organization. Therefore, the findings have to be fully visualized and created in a form that can be captured for later use.

» Capture and storage of information and knowledge – Once this initial information has been captured, it needs to be stored in a manner that makes it useful along the rest of the process, allowing additional value to be added to it so that it becomes knowledge. At each stage, the individual viewing the findings must be able to drill back down to the underlying data to be able to ensure that false findings have not been created, and to see if by adding additional data, the findings can be further supported – or discredited.

» Secure movement of information and knowledge – As with the data itself, the findings must adhere to all the security requirements that apply internally and externally to the organization. Identifiable data (e.g. credit card or National Insurance numbers) may need to be redacted partially or completely for certain viewers. Certain information should not pass over organization boundaries – whether this is to consultants or contractors working with the company, to partners, suppliers or customers. Certain data may be required to be ‘pulled’ by outsiders; some may need to be ‘pushed’ to them. The right engine to be able to manage all of this data movement in the most automated manner is crucial to ensuring that the maximum value is extracted from the available data sets.

» Provision of a library of resources – Users cannot be expected to be data savvy. Therefore, providing them with libraries of pre-prepared templates and functions can give them the power they want. These functions can be straightforward out-of-the-box things, such as data schema recognition tools, or can be functions that have been created by others in the organization and shared due to their value.
Case Studies

A major media company

Business issue:
The company has a massive user base dependent on the company getting things right. With over 6,000 data-driven jobs taking place between its datacenters and the cloud, it needed to create a more cohesive model for its business. It created a department of data scientists, tasked with analyzing the data and advising the company on possible new services. However, these data scientists were not IT professionals – any solution had to be usable by a non-technical person.

Thought process:
The company realized that it needed to create a means of simplifying the data processes so that the data scientists would receive the data they required, in the timescales needed. This dictated a move to an intelligent automation process.

Chosen solution:
The company chose Automic to provide it with the required data automation capabilities, through the use of the Automic ONE platform.

Business impact:
The company now has over 300 individuals interacting with the Automic ONE data automation software. It has leveraged the capability to use templates and adaptors to hide all the technical complexity from the data scientists, gaining the value it required.

A large power company

Business issue:
The company was implementing smart meters across its 10 million+ customer base. As well as being used for billing, the company wanted to ensure that these meters could be used in the future for other value add services. The company needed a means of processing the massive number of meter readings and identifying exceptions, so as to make the smart meter estate work to its advantage.

Thought process:
The company recognized that it faced a ‘big data’ challenge. It needed to automate as many steps as possible, to keep the possibilities of human-induced errors out from the overall process. It also wanted to free up its IT team from dealing with basic issues, so enabling them to focus on more value add innovative services.

Chosen solution:
The company turned to Automic for help. By using Automic’s data automation capabilities, meter readings, aggregation and analysis could all be automated. Only exceptions are now raised for human intervention and the help desk and IT department have moved from being mainly reactive, to a position where they can focus on researching, creating and implementing innovative services to add value to the company’s bottom line.

Business impact:
The company found that through using Automic, it has moved to a position of being able to take 86 million meter readings per day, and has reduced processing times by 70%.
Removing complexity through data automation

Humans are error prone. Even with simple tasks, a human can get it right ninety-nine times, but on the hundredth action, get it wrong. Computers do not work like this – as long as the task is correctly defined at the start, a computer will continue to carry out that task faultlessly for as long as is required. Computers also do not get tired, bored or less productive: using a computer to automate tasks results in better effectiveness (fewer errors) and better efficiencies (more throughput).

Therefore, it is in the organization’s best interests to ensure that automation is used wherever it can be implemented.

With data, there are lots of repetitive actions that should be automated.

Some of these are:

» **Data discovery** – By creating scripts that can be run on a regular basis, data sets that can add value to the overall pool of data an organization is analyzing can be gathered automatically. Such scripts can be run on an on-demand basis, or scheduled to run on a recurring basis as required.

» **Extract, transform and load (ETL)** – Data is not always in the best format for analysis and reporting tools to deal with. In many cases, it needs to be extracted from its original source, transformed into a format that is normalized against other data and then loaded into a different environment so that analysis can take place. In many organizations, such ETL work has been carried out in a manual batch mode. With big data and near-real time analysis, it is important that such actions are automated and run as regular, fast jobs to maintain data consistency. In some cases, such ETL work will need to be carried out on a continuous basis to enable that near-real time experience.

» **Data transfers** – Not all data will remain where it is placed after an ETL action. Some data may need pushing to another environment – for example, where a supplier’s production line data needs to be sent through to its customers, so that they can see the status of orders. Some data will need to be available on a pull basis, where automated scripts from other environments request that data be sent through to them as required. This pull approach becomes more important as the IoT/IoE evolves – the last thing that an organization’s network needs is for continuous broadcasting of small packets of data from masses of devices. Far better for the data from these devices to be aggregated and stored locally to the devices – and then for this data to be pulled to the center as required, through the center requesting certain data to be sent through.

» **Use of drag and drop** – although drag and drop interfaces themselves are not automation, the results of the drag and drop actions can be. For example, by dragging multiple data sources into one place, the system should be able to automatically identify the types of data, the schema of the data, and then to be able to carry out any ETL and data movement actions required. Drag and drop is the key to democratizing data: it provides users with the easiest means of understanding and dealing with disparate and dispersed data.

The main thrust of providing data automation has to be to offer greater levels of accessibility to the right data, to as many people as possible. However, training every person to become ‘data intelligent’ is neither cost effective nor possible. What an organization should be aiming for is that its users become ‘data savvy’ – each person should understand what data can do for them, and the platform provided to them should mask as much of the complexity of the ‘data intelligence’ from them.

Through this, each individual can become far more valuable to the team, department and organization: each individual feels more important as they find that data empowers them in their day-to-day work.
Conclusions

Data automation creates the capabilities to manage big data and the internet of things/internet of everything. Attempting to deal with the explosive growth of data with manual systems and slow batch processes will not provide the speed of information management that successful organizations will need.

Data variety will increasingly be a problem – it is unlikely that there will ever be agreement as to what format all the different sources should adhere to when creating data. Dealing with these diverse data sources and streams in a fast enough time to provide the accessibility necessary for all constituents of the organizational value chain requires a solid data automation platform.

Organizations must ensure that any system chosen can not only deal with today’s data variety, volume and velocity, but that it also enables greater veracity and value of the data to be managed. They also need to ensure that the system will be able to embrace and deal with new data types as they come through.

We are at the point where the IoT/IoE will start to have a major impact on the majority of organizations. Choosing the wrong data platform tools at this stage will end up being costly in terms of forced early replacement of the tools – but, more importantly – may well impact the overall effectiveness of any organization in this fast moving, high-volume data world.
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AUTOMIC, a leader in business automation, helps enterprises drive competitive advantage by automating their IT and business systems - from on-premise to the Cloud, Big Data and the Internet of Things. With offices worldwide, Automic powers over 2,600 customers including Bosch, Netflix, eBay, AMC Theatres, Carphone Warehouse, ExxonMobil, BT Global Services, Société Générale, NHS SBS, General Electric and Swisscom. More information can be found at www.automic.com.
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Quocirca is a primary research and analysis company specialising in the business impact of information technology and communications (ITC). With worldwide, native language reach, Quocirca provides in-depth insights into the views of buyers and influencers in large, mid-sized and small organizations. Its analyst team is made up of real-world practitioners with first-hand experience of ITC delivery who continuously research and track the industry and its real usage in the markets.

Through researching perceptions, Quocirca uncovers the real hurdles to technology adoption – the personal and political aspects of an organization’s environment and the pressures of the need for demonstrable business value in any implementation. This capability to uncover and report back on the end-user perceptions in the market enables Quocirca to provide advice on the realities of technology adoption, not the promises.

Quocirca research is always pragmatic, business orientated and conducted in the context of the bigger picture. ITC has the ability to transform businesses and the processes that drive them, but often fails to do so. Quocirca’s mission is to help organizations improve their success rate in process enablement through better levels of understanding and the adoption of the correct technologies at the correct time.

Quocirca works with global and local providers of ITC products and services to help them deliver on the promise that ITC holds for business. Quocirca’s clients include Oracle, IBM, CA, O2, T-Mobile, HP, Xerox, Ricoh and Symantec, along with other large and medium sized vendors, service providers and more specialist firms.

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