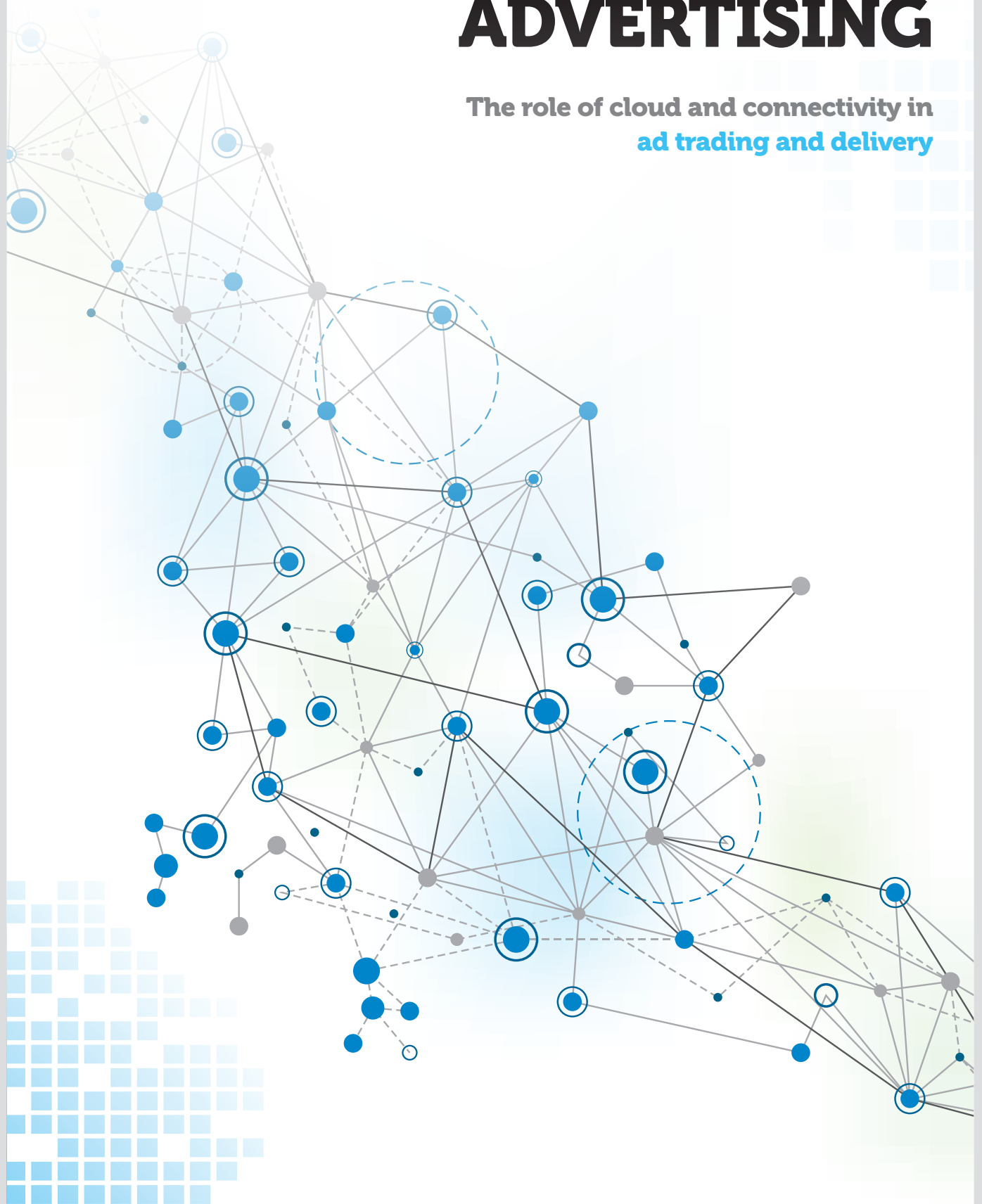


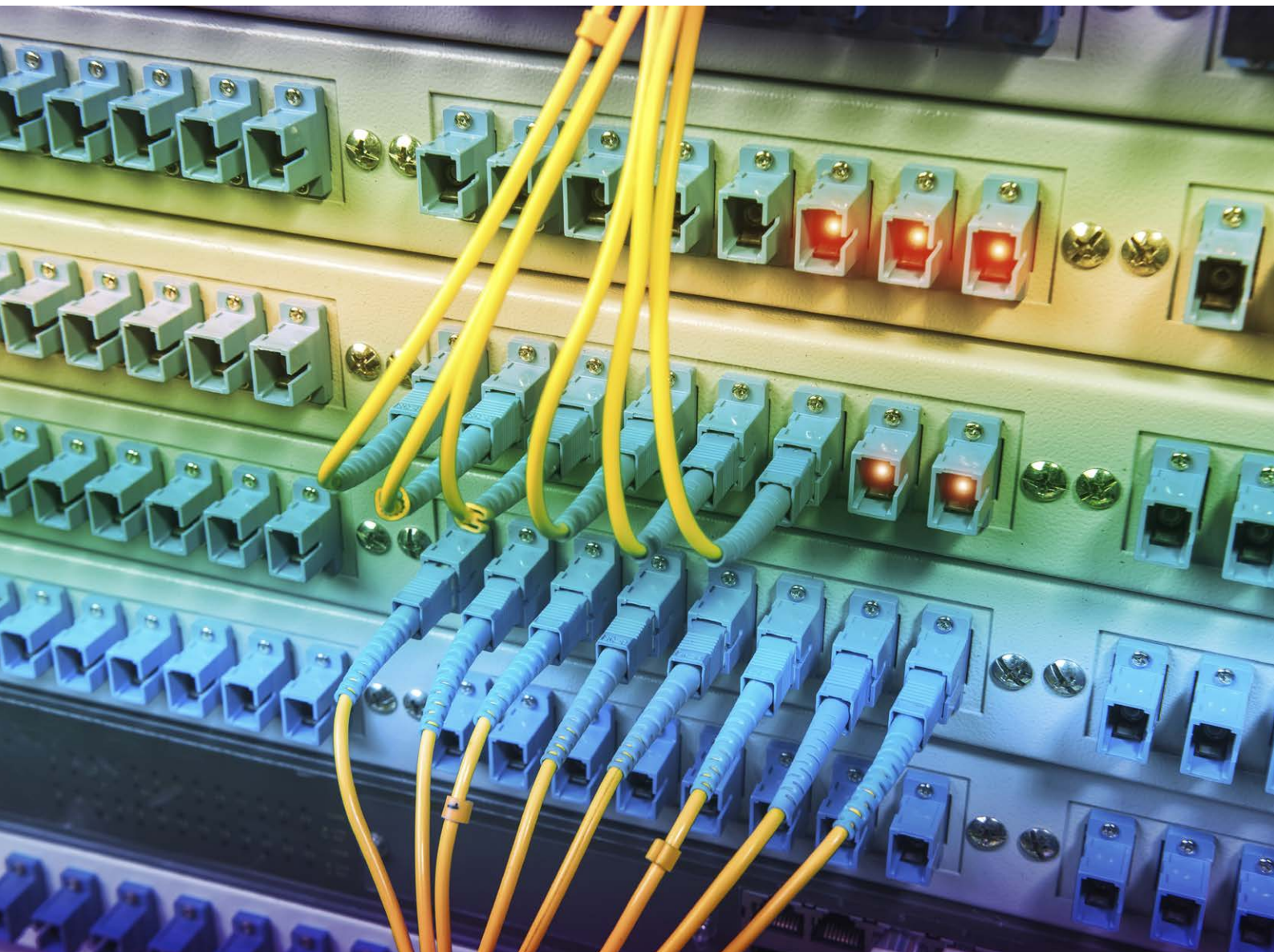
DIGITAL ADVERTISING

The role of cloud and connectivity in
ad trading and delivery



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INTRODUCTION

Digital media revenues are experiencing double-digit growth, and digital media accounts for 22% of total global advertising spend. Key drivers of this growth are:

- Continued consumer migration to digital and mobile media
- The unparalleled targeting and accountability that digital offers advertisers
- The growing sophistication of advertising offerings from major digital media owners including Google, Facebook and Twitter

Video and mobile advertising in particular are experiencing explosive increase in volumes and revenues.

Key drivers in digital advertising are reliance on programmatic trading and, particularly, real-time bidding (RTB), alongside increasing use of customer data for targeting and attribution. These trends are opening up significant opportunities in the digital advertising sector, but are simultaneously adding complexity to the media-trading value chain and the advertising technology (ad tech) landscape.

Drawing on findings from research interviews with a range of companies in the digital advertising sector, this white paper examines the impact of all these factors on the sector. It also looks at the infrastructure and connectivity solutions companies are deploying in response, focusing on:

- The importance of connectivity
- How companies are balancing dedicated infrastructure and cloud
- The role of the data centre in optimising performance

RESEARCH METHODOLOGY



UK-based research agency FirstPartner undertook qualitative research to explore the commercial and technical challenges facing digital advertising companies. In-depth telephone interviews were held with a range of companies representing all stages of the display and video advertising value chain.

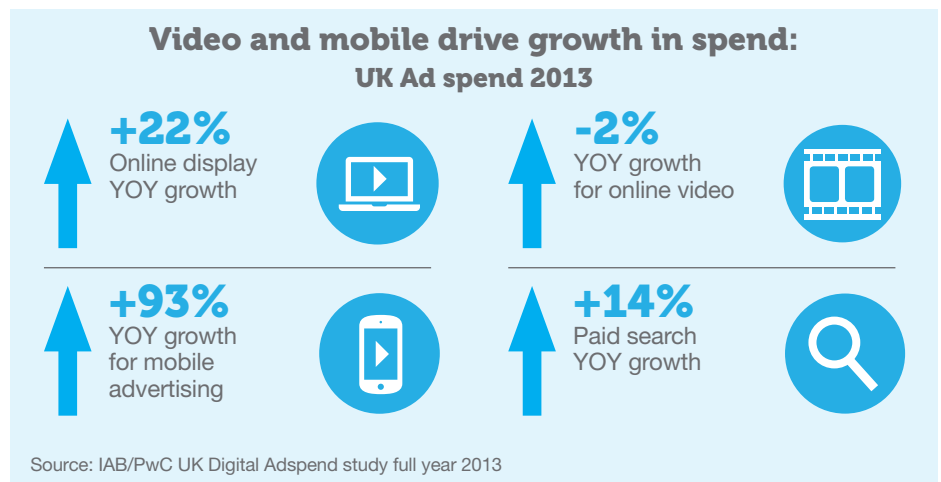
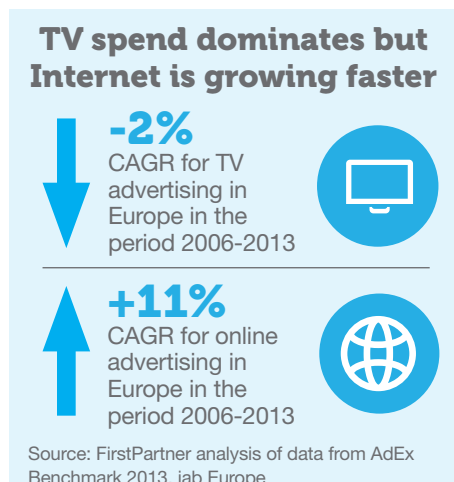
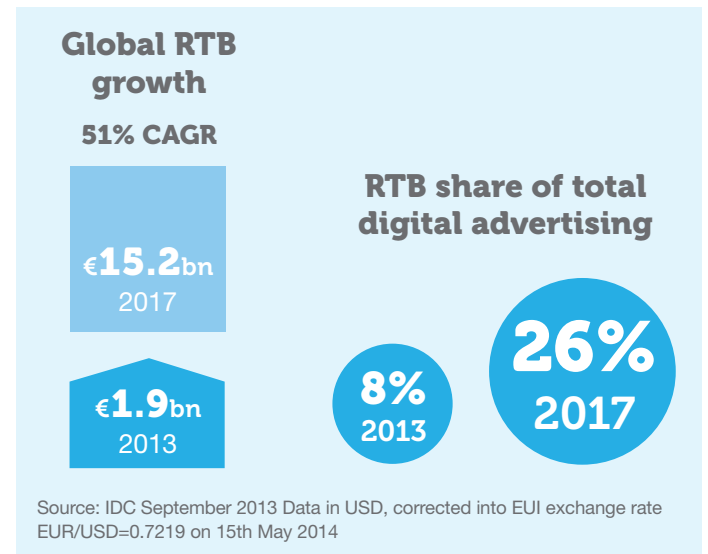
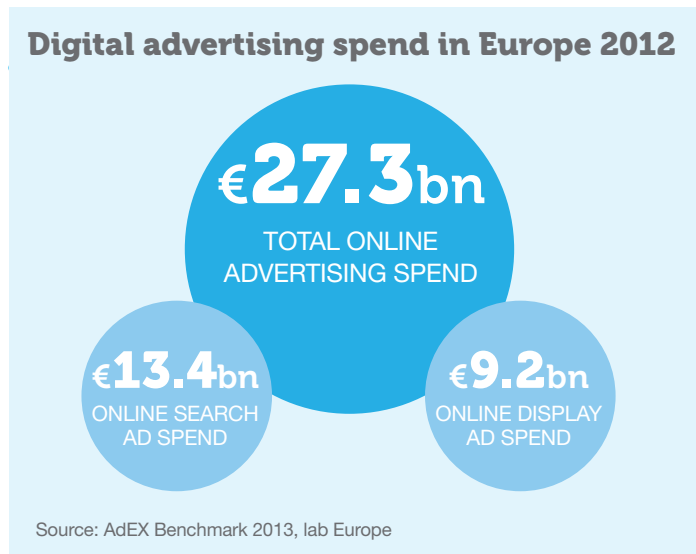


Figure 1. Growth in digital advertising

THE COMPLEX, DYNAMIC AND GLOBAL DIGITAL ADVERTISING MARKETPLACE

The digital advertising marketplace is thriving, providing many companies with annual double- and treble-digit growth. However, the value chain is complex with many interdependent players, making robust connectivity a pre-requisite for success.

The digital advertising sector is characterised by a complex value chain comprising a large number of fast-growing, interdependent agencies and tech companies. A small number of major players dominate specific media formats, notably Google in search and social video, and Facebook in social display.

Advertisers and publishers increasingly depend on a web of agencies and ad tech companies to develop, prepare and deliver ad creative, optimise and execute buying and selling strategies, and measure campaign performance.

Programmatic trading has increased this dependence significantly, and the opportunities presented by multiscreen and targeted video and TV advertising are expected to continue to drive the trend.

Growth in the sector and rapid technology innovation have created a fertile environment for both startups and more established companies to flourish. For example, Rocket Fuel and Pubmatic are experiencing ongoing 100%+ annual growth rates in traffic and revenues. The major established players, notably Google, Microsoft, Yahoo, AOL and Adobe and, increasingly, Facebook, have embraced programmatic and data-driven advertising through continuing acquisitions and organic development of their platforms.

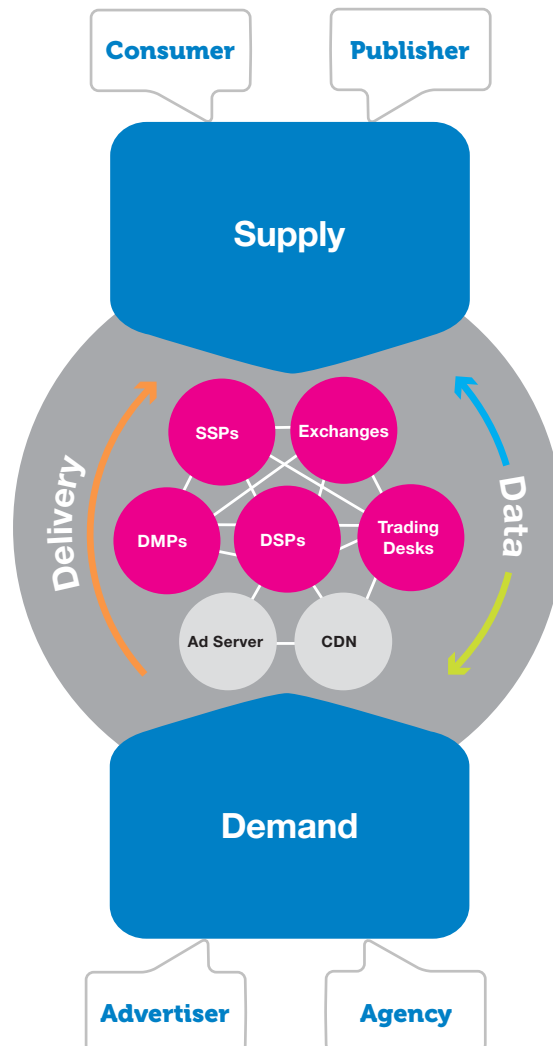


Figure 2. The complex programmatic value chain

GLOBAL REACH: A PREREQUISITE

Universal, global interconnectivity between companies in the ad trading community is essential. On the sell side, supply-side platforms (SSPs) need to enable their publishers to achieve global advertiser reach. On the buy side, demand-side platforms (DSPs) must offer their advertisers access to the maximum number of relevant publishers. To achieve this, individual SSPs and DSPs may be integrated with over 100 trading partners.

Programmatic trading and real-time bidding

Programmatic trading and real-time bidding (RTB) have grown rapidly over the five years since they first emerged. The two terms are often used interchangeably but there is a distinction between them.

Programmatic trading — the practice of fully automating the buying and selling of digital media without direct human intervention in a transaction.

Real-time bidding — a form of programmatic trading where individual impressions are traded in a live auction (via a public or private exchange).

The key players in the programmatic trading and RTB markets

Supply-side platforms (SSPs) — help a publisher connect to multiple buyers, to manage auctions and maximise the price achieved for available inventory. This is often referred to as 'optimising the yield'.

Demand-side platforms (DSPs) — used by advertisers and agencies to manage buying and place bids. The DSP uses customer data to target media buys effectively.

Trading desks — play a similar role to DSPs but are owned by an agency or agency group. They act on behalf of that agency and its clients, and enable aggregation of data across the agency or group.

Exchanges and marketplaces — aggregate audiences and inventory from multiple publishers and SSPs to provide a trading environment. Private exchanges and marketplaces allow publishers to restrict the pool of advertisers who purchase from them, to maintain prices and ensure brand fit.

Data management platforms (DMPs) — used by advertisers, agencies, DSPs and SSPs to combine first- and third-party data to build the customer profiles used for targeting and optimisation on both the buy and sell sides.

Data providers — provide anonymised third-party customer data that helps to build profiles. This may include demographic, purchasing-behaviour and financial data.

Advertising networks — aggregate inventory from publishers and provide a channel for publishers to sell to advertisers. Trading may be auction based, but is not true real time. SSPs may use these networks to distribute inventory, and DSPs may use them as additional inventory sources.

Ad servers — manage the delivery of an ad to a consumer. This functionality may be offered by DSPs and SSPs.

Content delivery networks (CDNs) — allow content to be cached across the Internet and delivered quickly and efficiently. Content in high demand will be cached near to the audience to minimise latency and bandwidth overheads. CDNs are often used to deliver the actual ad creative.

THE CHALLENGES AD TECH COMPANIES FACE

Trading and delivering ads at very high speed is a critical requirement, and depends on rapid interactions between partner companies. But inconsistent application of standards and protocols can make integration with partners time consuming and costly.

“Speed (is our key requirement around connectivity to partners). We are making hundreds of thousands of decisions every second because we are operating in a real-time advertising environment. So the key requirement is making sure we can do everything very, very fast... We can't get the right piece of advertising at the right price to the right publisher if everything is not moving at a very, very high speed.”

SSP

“To a certain extent we are a platform with 'a series of pipes' so anybody on the supplier side or the buy side needs to integrate with us through a series of protocols. We have our own variant of the RTB protocol, we obviously support the OpenRTB protocol. We can integrate on a server-to-server basis [or] through APIs. We aim to be open and extensible and flexible in that regard. So every one of those several hundred partners is integrated into our platform.”

SSP

RTB is probably the most technically demanding process in digital advertising. Our research indicates that the key RTB challenges include:

- The ability to integrate with multiple partners
- High-speed trading and delivery of ads
- Scale
- Reliability

THE INTEGRATION CHALLENGE: INCONSISTENT STANDARDS

Trading and delivering a real-time traded ad requires multiple communications and hand-offs between the various players in the chain. See Figure 3. A number of these interactions are handled by browser tags, video player integrations or mobile app SDKs. These transmit information that redirects the consumer's browser or app to complete the next stage of the process, for example, connecting to the right CDN cache to request the creative.

The critical connection is between the SSP or exchange and the DSP or trading desk — generally via an API. Lack of consistency in the way standards are applied makes integration with tens or hundreds of partners a challenge.

“Sometimes they have a simple reporting API to access the data. In other cases they want to load their data into our system so they can use their data for buying — so we do a pixel synch or a server-to-server data synch. So each one is not unique but every one is a little different. It depends on each buyer.”
Video and TV marketplace and platform provider

Although the OpenRTB standard was launched in 2010, was approved by the Internet Advertising Bureau (IAB), and has been widely adopted, its implementation varies by company. The implication is that each integration may need to be a custom development, placing undue overhead on companies and restricting their flexibility.

The complexity of the integration can also depend on the partner's level of sophistication.

“There is just an inherently higher level of complexity when you throw mobile into the mix... [there's] a lot more data with mobile. You have many more data parameters which makes the connectivity piece more complex and also in the mobile advertising segment there are a lot of companies with less robust technology and infrastructure. So you spend a lot of time getting a highly complex integration to work, and then you may find the infrastructure of that customer is not robust enough to do the business you are intending to do.”

SSP

Mobile raises additional challenges due to its relative immaturity and inconsistent approach, which affects:

- Tracking and user identification — this is further complicated by the fact that standard cookies do not work effectively on mobile, and ad traffic is spread across browser and app platforms
- Brand safety — making sure that appropriate advertising is matched with appropriate media owners, sites and apps

“Another important topic in the industry is transparency and brand safety. Currently some of our traffic sources are very good... for all the requests we see very neat, tidy site and app information that gives us 100% transparency, and we can report to agencies and advertisers exactly what sites and what apps we have been delivering into. However, for some of our partners, transparency is only a percentage of the total traffic we receive, which does cause... brand safety problems. For example you don't want to deliver a tobacco campaign to a children's app!”

Mobile DSP

THE SPEED CHALLENGE: TRADING AND DELIVERING ADS IN THE BLINK OF AN EYE

Every RTB ad needs to optimise:

- The match between the advertiser's target audience profile and the consumer it's delivered to
- The revenue generated for the media owner

The ad-specific trading and targeting required to achieve this depends on a complex, multi-stage request involving data lookup, bidding, auction and ad serving — all of which must take place within milliseconds to serve the right, highly targeted ad seamlessly as the web page or mobile app content loads on the consumer's device. See Figure 3.

THE REAL TIME BIDDING PROCESS FLOW

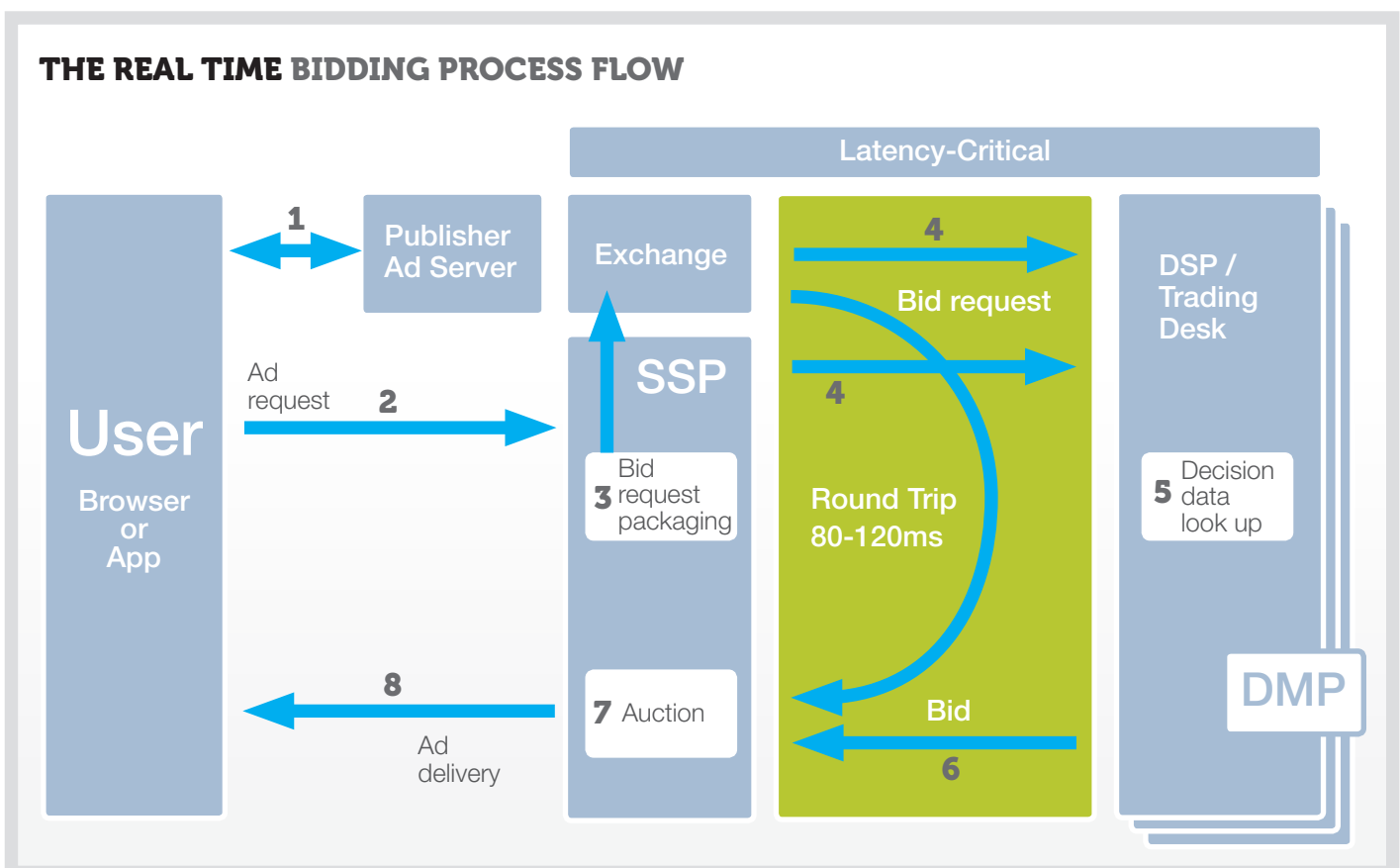


Figure 3. The simplified RTB flow

THE SIMPLIFIED RTB PROCESS

When a browser or mobile app requests content from a publisher, the publisher's ad server will trigger the trading process. First, the SSP checks the impression for auction criteria, prepares a bid request — in some cases enriching it with profile data — and invites selected partner DSPs or trading desks to bid on the impression. This may be done directly or via an exchange. The DSPs and trading desks that receive the invitation check the anonymised consumer (normally identified by a cookie) against a database of target customer profiles built from the advertiser's own and third-party data — often done by a DMP from a provider such as Oracle BlueKai. If there is a profile match with an advertiser's target audience, the DSP will submit a bid on the impression to the SSP or exchange that is running the auction.

For the process to run efficiently, the SSP or exchange must set a time limit between inviting, receiving and allocating bids — typically between 80 and 120 milliseconds. This brief period also has to allow for the DSP — and, in some cases, SSP — processing and data lookup time, and the round-trip delay between the SSP and the DSP.

“A lot of information needs to flow into our system every second and it has to be reliable. We can't wait. If there is any delay it affects the bid. We could lose bids. We can't have any latency.”

Independent trading desk

“Latency, followed by bandwidth, which in turn translates into time — which is again basically latency. Keeping latency as low as possible is key. Everything below 50 milliseconds is ok. Anything up to 200 milliseconds is not broken but is not desirable either. Above that, it starts to become a problem, especially in Europe and that is all end-user latency. For server to server I would be extremely annoyed to see anything much above what the physical light speed is for whatever region we are trying to reach.”

Video ad platform provider

If the time limit is exceeded, the DSP or trading desk will be unable to place its bid and will lose commission, and the advertiser will miss the opportunity to place the ad. With very fast response times a precondition for competing, the DSP or trading desk must deliver extremely quickly by minimising processing and database lookup time, and ensuring minimal network delay or latency.

“For our [third-party data] lookup the latency requirement is only 40 milliseconds... In order to get a very fast response we need to load a huge database into memory rather than letting it stay on the hard disk. So that cost and what programming language are you going to use, how good is the memory management of that language? — all these things should be considered in the first place.”

Mobile DSP

To further complicate matters, SSPs, exchanges, DSPs and trading desks must do this while dealing with massive concurrency, as they will typically be handling millions of transactions per second and matching consumers, publishers and advertisers on a global basis. For example, a consumer in Germany viewing a US publisher's website should see a relevant German ad, which could be served on behalf of a Korean company.

“We want API connectivity, we want intraday datasets and then we want minimal latency between the major markets of North America, the UK, mainland Europe and Asia.”

Trading desk

Dealing effectively with the combination of speed, concurrency and global trading requires significant processing and storage capacity, investment and physical presence in key regions. Rubicon Project, a major SSP, reports that its platform makes approximately 300 data-driven decisions per transaction within milliseconds, and executes up to 2.1 million peak queries per second. Leading DSP Rocket Fuel operates infrastructure that supports over 25,000 CPU cores in eight data centres, housing 15PB of data to deal with the tens of billions of bid requests it receives every day.

DELIVERING THE AD CONTENT

The process for serving and delivering the ad content is generally less complex and time bound than the RTB process — at least from the point of view of the ad tech companies.

Some ad tech companies offer an in-house ad-serving and delivery capability; others work with a publisher's or advertiser's own or third-party ad server. In most cases, the ad creative is delivered on behalf of the advertiser by a CDN such as Akamai or Limelight, although some ad tech companies operate their own CDNs.

Low latency is particularly important for video ad delivery: critical success factors include good CDN connectivity and the ability to peer directly with ISPs in a way that matches concentrations of, and growth in, traffic.

“There is a separation here between [video] content delivery and ad-request decisioning logic, mainly because content has higher bottlenecks network-wise. It's much more visible with the content.”

Video ad platform provider



STRATEGIES TO ADDRESS THE CHALLENGES

To meet the speed and integration challenges, ad tech companies must carefully consider the location of their infrastructure, how they manage connectivity, and how they optimise their software and database architectures.

As processing takes up the largest proportion of the 80–120 ≈ round-trip target, software architecture is a key consideration. There is some evidence that when bids are missed because of high latency, the issue is with the speed of data lookup rather than connectivity. Nevertheless, good connectivity is important because lower network latency allows more time for data lookup and processing.

CONNECTIVITY AND THE COLOCATION DEBATE

To address a global market, ad tech companies will typically have a data centre presence in one European, one Asian, and two or three US locations. To minimise round-trip latency, particularly on the critical sell side/buy side link, it's helpful to be physically quite close to key partners. One latency-minimising option to consider is colocating in the same data centre as partners.

Opinion is split regarding the extent to which companies are already doing this. A couple of the companies we interviewed consider colocation alongside key partners in the same data centre an ideal way to minimise latency.

“ There are going to be cases where it's definitely going to be beneficial especially if you are trying to serve APAC — a broad geographic area — and you have partners who have strict latency requirements. Then it makes a ton of sense to [colocate in the same data centre] because you can sit right next to them — or at least be in the same square mile as them... Somewhere like Europe is a little more interesting. Again it gets back to where am I serving into, which country... It would have to depend on the business case and the specific use case. ”

Video ad platform provider

In Europe there appears to be a concentration of ad tech companies in the northern European hubs of Amsterdam, London and Frankfurt, where wide-area connectivity is excellent and network latency between well connected facilities is not an issue. In these cases, there is limited benefit in colocating within the same data centre.

“ Yes definitely, [colocating with DSP partners] would be very good. It would bring down latency... But at the moment it is about finding a data centre with low latency to the different customer countries. Otherwise, if it's a DSP problem, then it's better to have a front end somewhere close to the DSP — that would probably be our approach. ”

Private exchange provider

“ Our data centres are in Amsterdam which is geographically close to our key supply partners. It is not of the utmost importance, but any time you can shave off network latency gives you more time for your bidding algorithms to crunch data and provide optimum bids. Hence close geographic locations tend to be a best-practice design consideration. ”

DMP/DSP operator

There are also practical considerations related to colocating with partners — notably the sheer number of partners a company needs to work with. And there are concerns about the cost of moving data centre simply to colocate, and about the commercial disadvantages if a company doesn't have freedom of choice about its data centre provider.

“ The general improvement in fibre connectivity over the last 10 years has demonstrated that colocation is no longer a necessity. Colocating can be expensive and can reduce flexibility, and the fact that more fibre is being rolled out to increase bandwidth and decrease latency changes the cost/benefit dynamic to favour non-colocation. ”

DMP/DSP operator

THE ROLE OF THE CLOUD

How are cloud services being used by companies in the digital advertising sector, and what role should cloud play in the infrastructure mix?

Cloud-based infrastructure — both public and private — is widely used in the digital advertising sector. Some companies host their core processes entirely in the public cloud. On the other hand, larger, mature ad tech companies often prefer to maintain dedicated infrastructure for their core processes.

When ad tech companies talk about how they use cloud, they're generally referring to Infrastructure as a Service (IaaS) or Platform as a Service (PaaS). (These and other cloud models are defined in the appendix starting on page 21.) Ad tech companies often offer services to their publisher, advertiser and agency clients on a Software as a Service (SaaS) basis.

FLEXIBILITY AND SCALABILITY

The benefits of cloud are perceived to be flexibility, scalability, speed of implementation and the efficiency of the pay-as-you-go pricing model.

“It's efficiency. You pay for what you use. You have that flexibility and you are not tied down. Any peaks and troughs you can accommodate.”

Ad server

Public cloud often plays an important role during an ad tech company's start-up phase, and is also seen as a flexible, relatively low-cost way to deploy points of presence in new markets. However, as companies mature, those that start in the cloud tend to shift critical data and processes to dedicated infrastructure in their own or third-party data centres.

“We use dedicated hardware in our major data centres, and some cloud services in some of the smaller expansion markets until we get to a size that justifies having dedicated hardware... [the benefit of] cloud is speed to implement and relative [capital] cost, whereas dedicated is scale, reliability and control, but obviously at a higher price point.”

SSP

CONTROL AND COST

The main drawback of public cloud, compared with dedicated infrastructure, is seen as lack of control — especially given that latency and business continuity are critical.

“It's lack of control, when the cloud goes down it can take you offline as a business which is obviously a high risk. Obviously a dedicated data centre and set of systems can also go offline... but we have direct control over remedying it.”

SSP

Cost is also a significant consideration. Given the current scale of their operations, some companies believe that it would be more expensive to use public cloud than their own dedicated infrastructure.

“Considering the volume of information we were working with, our [requirements for] latency and security, and the ability to query very large amounts of data, we found that it was better to have it hosted than to have it in the cloud.”

Independent trading desk

“All the comparisons I have done so far tell us that we would not be able to do things in the [public] cloud as it would be prohibitively expensive. We actually use [most of] our infrastructure as a private cloud.

For us [public] cloud is going to have less and less importance because we actually we want to move off [public] cloud services rather than on to them... And this has to do with how important we think it is to have control over your network infrastructure. Being in control of the latency and bandwidth, being able to get into peering agreements to the SSP and DSP. In the [public] cloud this is all abstracted from you and when you have latency issues it is pretty impossible to debug.”

Video ad platform provider

There is also some evidence that the impact of short-term peaks and troughs in demand on dedicated infrastructure decreases once critical mass is achieved.

“Historically it has been more relevant, but nowadays we have enough resources to increase our capacity.”

Video ad platform provider

There may additionally be a credibility benefit associated with dedicated infrastructure.

“It's just my opinion: I think it adds credibility because the publishers want to know how you manage your infrastructure.”

Ad server

It is difficult to calculate the definitive balance between public cloud and dedicated infrastructure. Not only will it vary from company to company, but public cloud pricing and the relative cost of dedicated hardware are changing dynamically, and will doubtless continue to do so.

“Is there a tipping point where it becomes more cost effective to have your own dedicated infrastructure instead of using the cloud?”

Yes there is, but I don't know where this is exactly. In the last couple of years we have moved from having the majority of our activity on cloud services to having our own dedicated hardware. And the cost saving from making that change has been pretty substantial...

And would that change looking forward 2 or 3 years?

I don't think so... we have obviously looked into it in making this investment and our view is that, over the medium to long term, the route we have gone down is going to be the right one for us between cost and performance.”

SSP

HYBRID INFRASTRUCTURE: THE WAY FORWARD?

There is no doubt that private and public cloud have a role to play in delivering ad tech infrastructure, but most likely as part of a hybrid model. This appears to be the favoured approach of maturing ad tech companies — one that combines dedicated infrastructure or private cloud for core, business-critical processes with public cloud for flexible expansion and support processes.

A potential challenge for hybrid infrastructure deployment is interoperability between applications that are distributed across private and public cloud infrastructures from multiple providers.

- At the environment level, cloud operating system initiatives such as OpenStack and OpenCloud are designed to orchestrate and manage large-scale cloud computing platforms across multiple data centres and providers. These initiatives are getting support from major IT players and could be instrumental in enabling cloud adoption to move to the next level in the ad tech sector.
- At the physical level, good connectivity to and between key cloud providers is a necessary enabler of interoperability, and should be a key consideration for companies taking the hybrid approach.

FUTURE DEVELOPMENTS

There is little doubt that the significant market growth and rapid technological evolution that have characterised digital advertising in recent years will continue for the foreseeable future.

Convergence between broadcast TV and digital advertising will be a particularly important area of opportunity. The increased focus on multiscreen TV delivery and the promise of targeted, personalised ads will drive closer alignment between TV and online buying and delivery models, and we can expect to see programmatic trading applied to TV.

The critical role of data in targeting and measurement will only expand, further fuelling requirements for massive compute and storage capacity, and increasing data security requirements.

And as reliance on programmatic trading continues to grow, the availability of high-speed connectivity and the drive to reduce latency will become increasingly important. Although connectivity in core North American and northern European

markets is excellent, RTB growth in southern and eastern European and Asian markets may raise new connectivity challenges. Some of our interviewees reported poorer connectivity and higher latencies in these locations. Serving these markets effectively may require deployment of additional points of presence in carefully selected data centres.

Consolidation and shake-out among programmatic ad tech providers is expected, which will bring additional platform and infrastructure integration challenges.

A key success factor for ad tech companies will be the adoption of strategies to optimise their infrastructure investment and operations across dedicated and cloud-based platforms.

CONCLUSION

This paper has looked at some of the key challenges faced by ad tech companies as they deal with significant growth, rapid technological innovation, and the maturation of their commercial and analytical models. The main issues identified were:

- The digital advertising value chain is complex and highly fragmented and involves multiple connections between partners
- Integration between SSPs and exchanges and DSPs is challenging because a common API standard hasn't been consistently implemented
- RTB and delivery of video advertising require very low latency, great connectivity and high levels of reliability

There are mixed opinions about the value of colocating in the same data centre as trading partners. Doing so can help to reduce latency, and lower latency allows more time for DSP data lookup and decisioning processes. But in the core geographic centres of the programmatic trading market, latency gains are likely to be marginal — especially for companies that house their infrastructure in well connected data centres, and select appropriate transit carriers and Internet exchange connections.

There are also practical considerations to bear in mind with colocation — such as which of your many partners you choose to colocate with. It's unlikely a company would consider switching data centres simply to reduce latency to a subset of partners by a few milliseconds. On the other hand, colocating with a handful of major partners could be worth considering when deploying a new point of presence — but the company must also maintain connectivity with the rest of its trading partners.

When it comes to cloud, companies often find public cloud a valuable enabler during their start-up phase, or when entering a new geographical market; but larger and more mature players favour dedicated infrastructure and private cloud for core processes, to maintain control over performance and availability.

In the medium to long term, we expect most ad tech companies will combine dedicated hardware with cloud-based processing, storage and services. Adopting this staged, hybrid approach will enable companies to progressively take advantage of the flexibility that cloud offers, without negatively affecting operational performance.

THE ROLE OF THE DATA CENTRE: CONNECTIVITY

A hybrid infrastructure model can bring connectivity challenges, especially if multiple cloud infrastructure providers are used to optimise cost, delivery capability and availability. This is where the choice of data centre provider and location becomes critical. Significant benefits can be gained by locating dedicated and private cloud infrastructure at facilities that offer:

- A wide choice of carriers able to provide high-bandwidth, high-availability Internet and dedicated connectivity at competitive prices
- Direct access to leading Internet exchanges for peering
- Direct access to major public and private cloud providers

Cloud and carrier-neutral data centres, such as those operated by Interxion, can provide a long-term, flexible home for companies in the digital advertising sector who want to deploy their own or hybrid infrastructure in a highly secure environment with the widest range of connectivity options. Major carriers, Internet exchanges and CDNs have points of presence at these data centres, ensuring a highly competitive selection of transit connectivity and peering options, in addition to high-capacity cross connects among partner organisations within the data centre. These neutral data centres are also home to cloud-based video service providers and specialist cloud providers, and offer solutions for direct connection to the main public cloud providers.

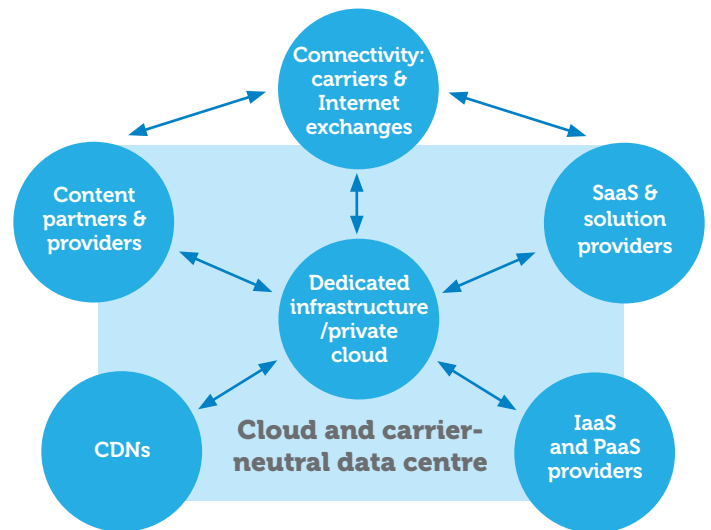


Figure 4. The cloud and carrier-neutral data centre environment

Selecting a data centre provider that can demonstrate an in-depth understanding of the advertising and media sectors can also be advantageous. This type of provider will be in a better position to advise you on hosting and connectivity options; to attract a diverse community of organisations from within and serving the advertising and media sectors; and to support you in optimising the deployment of your infrastructure.

KEY TAKEAWAYS

- ✔ Optimised, high-speed connectivity between partners is key, especially for programmatic trading and RTB
- ✔ Reducing network latency allows more time for processor-intensive real-time data lookup and decisioning processes
- ✔ Opinion is split on whether physical colocation with key partners is the optimum approach — potential latency reductions must be reviewed against practical barriers
- ✔ Cloud infrastructure has a role to play, especially when companies are starting up, expanding geographically, or need access to more compute or storage resources on demand
- ✔ Maturing companies prefer the control and cost savings that come with dedicated self-managed infrastructure for core processing and storage
- ✔ A hybrid approach is likely to be the way forward for many companies, providing they can establish good connectivity between their own and cloud-based platforms

APPENDIX: UNDERSTANDING CLOUD AND SOFTWARE DEPLOYMENT MODELS

The term 'cloud' is often used loosely to denote different services and infrastructures, which can lead to confusion and inconsistency. For clarity, we've defined the main cloud models that are relevant to the digital advertising sector. Ad tech companies and agencies may select one or more of these options to meet all or part of their requirements.

In this paper we use the term 'public cloud' when we are referring generically to an option that may be fulfilled by any of the public cloud models. If a point is specific to an individual model such as IaaS or SaaS, we use that term.

INFRASTRUCTURE AS A SERVICE (IAAS)

This is the basic cloud service, providing resources such as virtual machines (VMs), network load balancers, storage and connectivity. In this model, computing resources such as CPU, memory, storage and network are added to a VM, on which an application is then deployed. The underlying infrastructure is managed by the cloud (or IaaS) provider; and the customer of the infrastructure maintains their own applications on it.

PLATFORM AS A SERVICE (PAAS)

PaaS is the next layer up from IaaS. With PaaS, computing platforms, operating systems, databases and applications are delivered by the cloud provider. Customers deploy onto, and developers write code for, the platform. This is often a highly automated and scalable environment.

SOFTWARE AS A SERVICE (SAAS)

The top layer is where the application software is installed in the cloud and accessed by the customer. The SaaS provider manages the software and all the underlying technology, effectively renting the software to its customers.

IaaS, PaaS and SaaS can all be deployed in public, private and hybrid cloud environments.

PUBLIC CLOUD

A public cloud infrastructure is one that is made generally available to enterprises and individuals by its owner. Public clouds include those owned by Amazon, Microsoft, Google and IBM.

Pros: initial cost savings, flexibility, scalability speed and ease of deployment.

Cons: possible lack of control, perceived security concerns, possibility of higher costs over the long term compared with dedicated infrastructure.

PRIVATE CLOUD

A cloud infrastructure operated for an individual organisation that uses it to run its own applications, to deploy software, or to offer SaaS to other enterprises. A private cloud can be installed on the organisation's own premises or in a third-party data centre.

Pros: the benefits of public cloud without any concerns about control and transparency; can be designed to meet specific requirements.

Cons: Less flexibility, less scalability and higher initial costs than public cloud.

HYBRID CLOUD

A combination of two or more compute platforms (for example, in-house infrastructure and public cloud) that are separate but connected, and enable data and application portability and interoperability, for example, bursting onto the public cloud to handle peaks in demand that exceed trended norms.

Pros: the best of both worlds — flexibility, scalability and savings with security and control.

Cons: the most complex solution to set up and manage, requiring specialist expertise and excellent connectivity.

VIRTUALISATION

Virtualisation is the creation of a virtual version of a device or resource, such as a server, storage device, network or operating system where resource is divided into multiple execution environments. Virtualisation is most commonly associated with servers — the partitioning of a physical server into smaller virtual servers — a technique that helps organisations to make more effective use of compute capacity by running multiple applications on a single physical server.

INDUSTRY ASSOCIATIONS

Cofounder: Uptime Institute
EMEA chapter

Founding member: European
Data Centre Association

Patron: European Internet
Exchange Association

Member: The Green Grid,
with role on Advisory Council
and Technical Committee

Contributor: EC Joint Research
Centre on Sustainability

Member: EuroCloud

ACCREDITATIONS

ISO 22301 Business
Continuity Management



BCMS 560099

ISO/IEC 27001 Information
Security Management



IS 537141

ITILv3-certified Service Centre
Members and Facilities Managers



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