Enterprise Case Study: Using Cloud to Accelerate 3D Rendering

How YellowDog used cloud and crowdsourcing to accelerate and improve the rendering process
Summary

Catalyst

The initial concept of Bristol-based YellowDog's founders was to apply unused compute cycles from PCs and data centers to compute-intensive tasks such as the rendering of animations and stills for film and design studios. The company developed a platform that abstracted the complexity of the underlying infrastructure, while at the same time presenting customers with an easy-to-use interface that addressed the business complexities of the rendering process, including time to delivery, pricing, and quality. YellowDog is continually evaluating cloud infrastructure vendors for new and differentiated options to make available to their users as a part of normal business operations. When YellowDog completed its evaluation of Oracle Bare Metal Cloud Services, they determined that Oracle is delivering the highest level of cloud infrastructure performance by a significant margin, and made the decision to offer Oracle as an option within their product.

Ovum view

As the cloud market matures, the principles of highly scalable, on-demand infrastructure capacity accessed on a pay-per-use basis becomes applicable to a wider range of business processes. In the SaaS market, the infrastructure is already abstracted from the customer, who can potentially also make use of a PaaS layer for further application extension or composition. At the Infrastructure-as-a-Service (IaaS) layer, despite improvements in management tools and automation, customers must still deal with the provisioning and management of the service. This has led to a rise in managed cloud services, particularly for business-facing applications, whereby customers can take advantage of the benefits of cloud, without being concerned about the underlying intricacies.

YellowDog's innovation has been to construct a platform that can span multiple public cloud and private compute sources, and implement a business workflow on top of that platform that meets the needs of a specific customer audience. Part of that process includes benchmarking the performance of the underlying cloud infrastructure in order to give an accurate estimate of price and time for each rendering job. In doing so, YellowDog has highlighted both the peak performance and performance per cost advantages for compute-intensive tasks offered by Oracle Bare Metal Cloud Services.

Key messages

- 3D rendering is a compute-intensive process, prone to complexity.
- YellowDog identified an opportunity to exploit underused compute capacity.
- YellowDog was an early adopter of Oracle's high-performing Bare Metal Cloud Services.
- End-to-end automation of the rendering process has reduced cost and improved quality.
- YellowDog's platform can potentially be applied to other compute-intensive tasks.
Recommendations

Recommendations for enterprises

Digital service provider start-ups can use technology to move quickly and compete on a wider scale. The use of off-premise resources for web application development and scaled out deployment, when coupled with agile development and lean start-up methodologies, can generate sophisticated solutions within a relatively short timeframe, and the use of cloud can scale that solution to a wide potential audience. Technological innovation plays a key part in many of these propositions, but it is also important to keep sight of how that technology solves a real business problem, and provides maximum value to the end customer.

Start-ups should look for opportunities to partner for both business and technology support, finding the right help to accelerate their business proposition, and taking advantage of the wealth of advice that is available from business incubation programs, innovation funds, and partner programs. Choosing the right partners both locally and internationally can also provide access to a large potential customer base, and support for growing the business to the next stage.

Recommendations for vendors

In a competitive market for skills and innovation, vendors should build programs to identify and nurture technology start-ups, providing them with access to advice, resources, markets, and in some cases investment capital. These programs can provide a range of direct benefits including access to technology innovation, relationships with skilled entrepreneurs, and the creation of new ecosystems, as well as indirect benefits in terms of brand reputation and marketing.

Cloud services help to level the playing field for start-ups, enabling them to gain visibility and compete on a wider stage. Vendors can make use of this dynamic to inform their cloud services roadmap, using willing innovators to test their ideas in the cloud, provide feedback on possible improvements, and act as pathfinder references for mainstream adopters.

Developing a cloud service to simplify 3D rendering

Setting the business context

3D rendering is a compute-intensive process, prone to complexity

With an increasing amount of digital content, the demand for 3D rendering from film studios, graphic designers, animators, and special effects companies is growing rapidly, and as these creative industries adopt ever-higher resolutions (e.g. the transition to 4k video), the compute-intensive nature of the rendering task increases still further (Figure 1 shows that video encoding and rendering is a top IT project priority for film studios). To give an idea of this scale, a single frame in an animated movie might take several hours to render, with an entire feature-length film potentially requiring millions of CPU hours to complete.

Some studios have made the decision to build on-premise render "farms" (a more mission-specific version of the corporate data center), comprising thousands of servers to handle this task – but this is...
not a cost-effective solution for all but the largest businesses to construct and run firsthand. There are also third-party commercial services available that are running these large infrastructure installations, but this solution has up to this point suffered from unpredictable performance and workload completion times, unclear total costs, and frequent occurrence of rendering errors.

**Figure 1: IT project priorities for film studios**

YellowDog identified an opportunity to exploit underused compute capacity

UK-based YellowDog was born from an idea from co-founder Gareth Williams, an experienced technology executive, who observed the surplus of compute capacity going to waste across data centers, PCs and laptops, and even smartphones. Williams asserted that if this capacity could be aggregated, those spare cycles could be applied to any compute-intensive task.

Having undertaken some market research, the 3D-rendering process presented itself as an ideal candidate, so working with CTO Simon Ponsford, the pair set about understanding the business and technical challenges of the process, with a view to offering an innovative solution to the problem. They realized that the platform would need to not only meet the technical challenges, but also address the business issues that were creating a poor customer experience for those seeking 3D-rendering services. Initial funding for the company came through a successful crowdsourcing round, which was followed by further angel investments. YellowDog has also taken advantage of the University-sponsored SETsquared business incubation program, joining the scheme based at the Engine Shed in Bristol, UK, which has proved invaluable in providing advice and supporting the company’s development.
To build its platform, YellowDog decided to work with Telesoftas, an experienced outsourced development team headquartered in Lithuania, in order to get a development team up and running quickly. The team now consists of eight dedicated developers, who work using an agile Scrum methodology, and YellowDog has been very pleased with this arrangement, observing that good communication has been essential to the relationship. From the company’s inception in January 2015, Telesoftas had a beta version of the platform ready by June of that year and, after extensive testing, the product was launched in November 2015.

The resulting service provides an easy-to-use portal which simplifies the workflow, enabling customers to provide metadata from their stills or movie scenes, adjust the parameter of compute power (based on number of cores), and get an upfront cost and predicted time for their job. The job is then uploaded to the portal, and can be monitored through the rendering process. The YellowDog platform also undertakes extensive quality checks, to ensure that there is no data corruption during transfer and no dropped frames. This is very much in contrast to other prevailing services, where customers often have to manage the workflow for themselves, and where quality issues are common.

The platform also supports all of the popular graphic design applications and rendering engines, including Autodesk 3ds Max, Maya, Cinema 4D, V-Ray, Redshift, and Corona. Other applications can be supported via plugins as required. YellowDog also takes care of all of the software licensing issues for these applications as part of its service.

From a supply-side perspective, as data center budgets tighten, infrastructure managers are looking for ways to defray costs, and the opportunity to turn under-utilized capacity into a source of revenue is appealing. As with the demand side of the platform, YellowDog has automated the process of contributing and aggregating capacity from multiple sources, to make it simple for providers to contribute their compute horsepower.

The role of ICT in solving the problem

YellowDog was an early adopter of Oracle's high-performing Bare Metal Cloud Services

While the original spark for YellowDog's platform was to crowdsource compute capacity, it also needed public cloud capacity in order to scale-up its operations, so the company has established partnerships with several cloud providers, enabling it to offer up to 198,000 cores at peak capacity (with the potential for virtually limitless further scale-up on demand). Some customers also preferred to use public cloud providers for security reasons. One of these partnerships was with Oracle, which first brought its IaaS offering to the market in 2012. YellowDog was able to work with Oracle's local cloud team in its home city of Bristol, initially using the provider's VM-based cloud offerings. In 2016,
however, it was offered the opportunity to test Oracle’s new bare metal IaaS capabilities, which produced dramatic results. YellowDog found that the Oracle Bare Metal Cloud Services were at least twice, and sometime up to ten times as efficient as its existing providers for 3D-rendering tasks.

Oracle’s Bare Metal Cloud Services are designed and deployed with at least three fault-independent availability domains in each region, with a low-latency, high-bandwidth network interconnect, enabling a range of high availability application architectures. Resources are virtualized and provisioned at the network layer, enabling on-demand bare metal compute instances, which offer extremely high peak and predictable performance to the tune of millions of IOPS per instance. This fits well not only with YellowDog’s rendering customers, but also other intensive workloads like transactional databases, Big Data frameworks, and machine learning. Network virtualization also gives customers the maximum flexibility over the stack they use, and allows for a zero-trust relationship between the customer and the provider, and the host and the network. Finally, every workload runs in a private overlay network, which isolates workloads from each other and increases security.

For YellowDog, this translates directly into increased price/performance, with additional benefits from a global data center network, security, and high availability. The company has found that Oracle’s APIs are not yet as sophisticated as some of its other cloud providers, but YellowDog and Oracle have a strong working relationship at both local and corporate levels, and are collaborating on further enhancements to the service. YellowDog expects that a large majority of its public cloud usage will make use of Oracle IaaS by mid-2017. Other partners include AWS and French company OVH, and YellowDog can now integrate new public or private cloud providers into its portfolio, and an increased uptake of standards such as OpenStack has made this process easier.

**End-to-end automation has reduced cost and improved quality**

Although the rendering process is a technically complex one, the YellowDog platform aims to hide all of this from the customer. To use the platform, customers download a YellowDog plugin, and are then able to upload their files for rendering, selecting their preferred parameters of speed and cost for their job, and YellowDog uses predictive algorithms to forecast the cost and time, presenting the customer with a fixed price. Each rendering job is broken up into small discrete chunks (usually down to the level of an individual frame) which can be distributed across multiple clouds for execution.

To maintain security, the customer’s files are encrypted as part of the upload process, and individual chunks remain inside an encrypted partition on the cloud provider’s machine. Customers can also choose to use dedicated render servers on a subscription basis: YellowDog offers three performance tiers of 8-core Value servers, 16-core Standard servers, or 32-core Delux servers. Behind the scenes, YellowDog periodically benchmarks its cloud providers, so that the algorithms are kept up to date in terms of their forecasts.

Crowdsourced contributors of compute capacity can download a YellowDog application onto their machine, and are then able to received individual chunks of larger projects for processing. On the target computer, the YellowDog software effectively runs in a virtual machine, with all of the data being encrypted, so that it is fully isolated from other workloads. Providers can also set parameters for when the software runs, and how much CPU time it can consume. The rewards are relatively modest – in the order of a few pounds per week, which can optionally be donated to charity (a model reminiscent of the SETI@home initiative launched by University of California, Berkeley in 1999, and still in operation today).
YellowDog’s platform can be applied to other compute-intensive tasks

YellowDog now has almost 500 customers who have registered for its service, with around a quarter of these currently paying to use the platform. The market for rendering is growing rapidly, at between 14–18% per annum, with creative centers in countries including the US, Canada, the UK, and France, and production centers in locations such as India, China, Indonesia, and the Philippines. The inexorable increase in areas such as video games, special effects, virtual reality, and children's TV shows are all driving demand for YellowDog's services. The company currently has five staff in the UK, and plans to open a US office in 2017. YellowDog is a good example of how cloud technology and cloud providers can enable a young company to quite quickly establish a global reach and scale.

Looking further forward, YellowDog's platform concept could be applied to other compute-intensive tasks, outside of the film and graphics sector. It is currently looking at a number of other areas, including deep-learning algorithms in the artificial intelligence space, which is a growing area that requires plenty of compute capacity. YellowDog is now able to use GPUs to process workloads, which is a key technology for AI. There are also opportunities for YellowDog to apply the principles of its crowdsourcing technology back to the enterprise, helping those with unused data center capacity to improve their utilization rates, so there are several interesting possibilities for the company to apply its technology in adjacent areas.

Lessons learned

Abstract cloud complexity to focus on your core business

There is much to admire in the YellowDog platform, particularly the ability to break down jobs into smaller parts for parallelism and speed of execution, the ability to federate across multiple clouds, and the core concept of crowdsourcing compute capacity. But from a customer perspective, these are really of little relevance — what they want is for their rendering jobs to execute quickly, correctly, predictably, and in a cost-effective manner. That is what YellowDog has successfully achieved in simplifying the business process of rendering, and what really adds value for the customer. Any digital service provider using a cloud platform to deliver its proposition would do well to follow suit.

Choose cloud providers carefully in a dynamic market

The cloud market, particularly in the IaaS and PaaS arenas, remains highly dynamic. While the initial phase of the market was dominated by three large providers, the accompanying ecosystem continues to develop, with new entrants, new partnerships, and new technologies — all of which can change the balance of competitive advantage. Digital service providers should therefore choose their cloud partners carefully with a number of parameters in mind including performance, customer support, flexibility, and ecosystem. As much weight should be given to finding the right fit in terms of business relationship as is accorded to the benefits of the technology roadmap.
Appendix

Methodology

Ovum Enterprise Case Studies leverage in-depth interviews with key enterprise stakeholders, as well as a review of any available documentation such as strategic planning, RFP, implementation, and program evaluation documents.

Further reading

"Bare metal becomes a key part of the Oracle IaaS cloud story," IT0014-003222 (January 2017)

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