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Cloudflare PM Internship Application Challenge

My internship at Wayfair was canceled yesterday, and I'm incredibly grateful to have this opportunity to apply to Cloudflare. Thank you in advance for your consideration, and hope to hear back from you soon.

Thesis & Summary

Cloudflare Workers for Gaming (CWG) should focus on **providing video game developers more creative flexibility** developing for **casual players who want access to a wider variety of graphically intensive games, with multi-platform and multiplayer support**.

Taking advantage of advancements in WebAssembly and WebGL, CWG can provide consistent, high-quality streaming at any location and even during peak hours, with automatic scaling across thousands of servers and incredibly fast cold start times. With several times the compute per dollar compared with traditional cloud services, CWG can also price its game service at a level much more competitive with traditional mobile and PC/console devices.

Goals/Questions to Answer

How do we deliver a Cloudflare Workers for Gaming offering to the video game market? What do video game developers want? What do video game players want?

Users

First-party developers: Developers that are part of a video game console manufacturing company. For example, Nintendo makes consoles and develops exclusive games. **Not great for CWG**.

Third-party developers: These developers work for publishers, either through a business contract or as an in-house development team.

Middleware: Technically not video game developers, these companies develop production tools, including game engines, and other add-ons.

Mobile gaming: Mobile games generated around $60 billion dollars in 2019, accounting for around half of the entire gaming market.

For CWG, targeting third-party developers and mobile gaming developers would make the most sense. Additionally, it is important that CWG has support for middleware tools (for example, Unreal Engine can use Emscripten to compile projects into JavaScript).

Interviews with video game industry experts may reveal more information on developer workflows and insights into the direction of the industry. All of the following developer wants should be confirmed through these interviews and/or surveys: easier deployment, tools and languages that need to be supported, creative freedom with graphics and visuals, and more consistent revenues.

For video game players, a broad survey of players (either conducted by Cloudflare or purchased through a market research firm) can reveal more information on preferences, including the importance of exclusive titles, multiplayer support, good graphics, gaming locations, subscription pricing, and minimal acceptable latency.

Pain Points

These are things that lower the ability of developers and players to get what they want.

Game developers: Hardware limitations affect development decisions, more computing and graphics power can open up more creative and artistic freedoms for designers, but also restricts the audience. Mobile games are limited by mobile hardware, and mainstream games might not run on a basic laptop.

Players: Exclusive titles force either choosing one console over the other, or purchasing multiple gaming systems. New games might require purchasing expensive hardware or upgrades. For mobile gamers, the limitations of mobile graphics could also be a pain point, limiting the game selection to mobile-first games.

Existing Solutions

Existing solutions similar to what CWG might offer include Shadow, Nvidia's GeForce Now, Google's Stadia, Microsoft's xCloud, and Sony's PS Now. Shadow is the most expensive, but it gives players their own low-latency virtual Windows 10 PC, which supports all regular PC games. In testing the latter four, reviewers have praised the visual quality of the streamed games, but input lag was unacceptable, and title availability was a big concern.

Risks & Limitations

One of the biggest obstacles is WebGL. Being based on OpenGL ES, it lacks many features of OpenGL, including 3D textures, vertex array objects, and certain shaders. For developers who want their games to have the highest visual quality regardless of the platform, CWG cannot offer the same graphics features as native development.

Another big risk is the advancement of mobile and PC hardware. For casual players that do not care as much about latency nor the best possible graphics, mobile and PC hardware is only getting faster and cheaper. The upcoming PlayStation 5 and Xbox Series X are likely going to be priced around $500, with support for 4K gaming, and with a likely lifespan of 6 years—or around $7 per month. Along with the allure of console-exclusive titles, an expensive subscription for a cloud gaming service could be hard to justify, especially if that subscription doesn't include games. Consoles are also offering streaming from the console itself, which can allow users to play console-quality games on other platforms at home.

CWG focuses on a particular player type: the casual gamer who wants better visuals but not the absolute best, low latency but not at competitive gaming levels, and a low subscription price that also includes access to many good titles, but no first-party console-exclusives. We need to determine if that market is big enough to be worth it for developers.

Features for Cloudflare Workers for Gaming

In addition to the computing, automatic scaling, and cold start advantages enjoyed by Cloudflare Workers, features of CWG should include seamless integration with developers, mobile and PC gaming applications (or partnerships for game delivery), and low-latency multiplayer support.

C++ developers can compile directly to WebAssembly, and many game engines and other tools also support WebAssembly as a target output. CWG should ensure all of these tools are supported and compile-times are as quick as possible.

Developers also want to have confidence that the platform offered by CWG will have enough players to make the increased costs of porting games to WebAssembly worth it. Developers want users, and users want titles, so early contracts for titles will likely need to be established to build up the platform. Partnering with a company like Shadow that does not have the extensive cloud presence of Google or Microsoft could be a good addition to CWG's service.

Cross-platform multiplayer support is likely one of the most difficult features for Cloudflare to implement. Many AAA-multiplayer games rely on a client-server model, with rendering of most game objects done locally, and inputs, player positions, and environment updates sent to and from the central server. For CWG, the isolates distributed across many data-centers need to handle the "local" processing and rendering of the game, while also supporting protocols to communicate with another central server that handles the multiplayer interactions.

Development

To improve CWG prior to release, it is important to get lightweight processes in place and test them as they would be used by video game developers. It is also important to prioritize features that matter most for the developer and the player experiences, and ensuring positive expectations are established and met prior to release. Running a closed beta can control the narrative of the product while collecting valuable feedback from both groups. Partnering with key developers to offer a variety of titles is also important, so that the platform has enough recognizable titles on launch that users will be willing sign-up.

Metrics

Technical measures of success include input latency time, game load times, multiplayer latency times, and time added to the game development process. All these times should be reduced to be as close to a local gaming experience as possible.

Post-release measures of success include number of developers using CWG, monthly number of active players using CWG, and weekly user growth rate.