

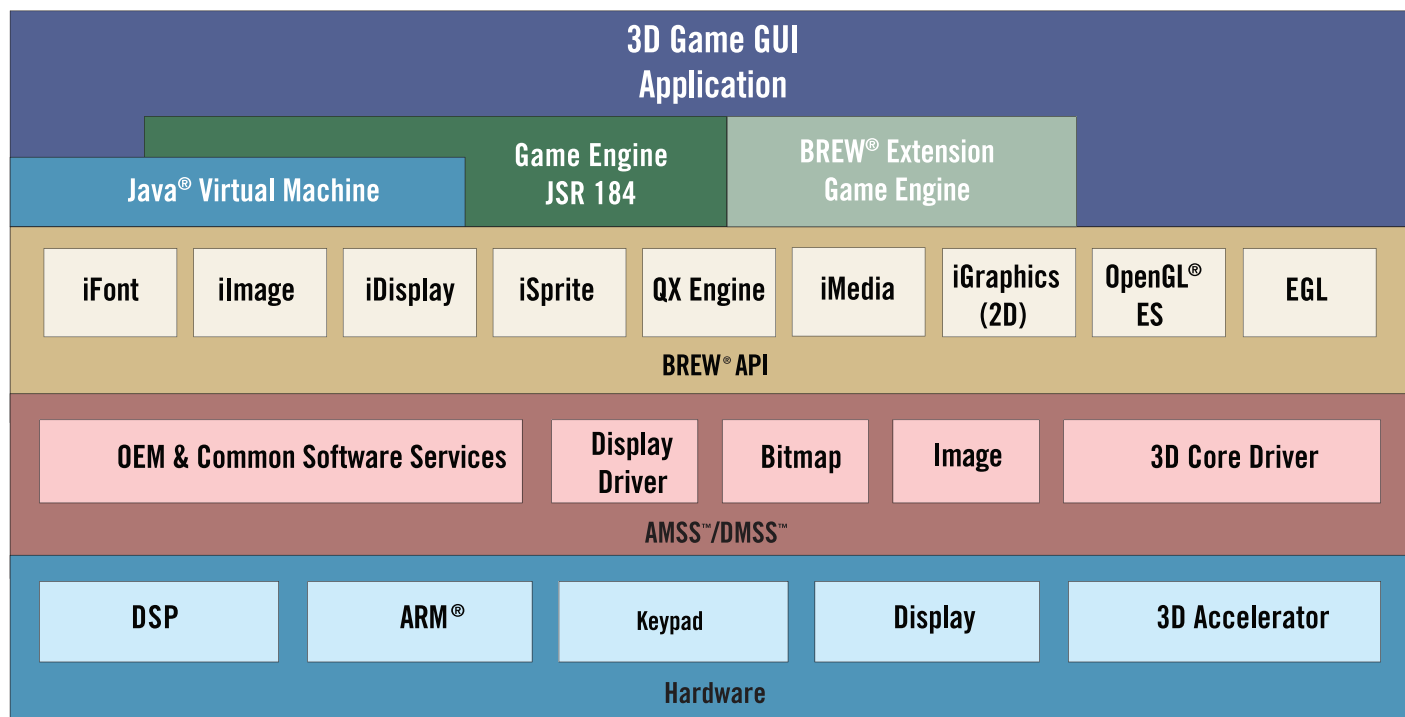
Q3DIMENSION™ GAMING PLATFORM

QUALCOMM CDMA TECHNOLOGIES

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ENABLING THE FUTURE OF COMMUNICATIONS™

Q3DIMENSION™ GAMING PLATFORM



Q3Dimension™ Gaming Architecture

Overview

The number of wireless gamers in the United States is expected to grow from 22 million to 124 million people by 2006 as new devices and services bring accessible gaming entertainment to all. Increase in demand, combined with the extreme processing requirements for gaming, pushes the envelope of technical innovation for wireless devices where power is already at a premium. Operators and manufacturers need to deliver lower power, content-rich 3G wireless devices with faster CPUs, dedicated graphics processors, high-resolution, full-color screens and advanced multimedia capabilities - features essential for a rich gaming experience.

QUALCOMM's Q3Dimension™ 3D graphics solution provides the same high-performance gaming as today's cutting edge handheld devices, further enabling wireless adaptation of the world's most popular PC- and console-based games. Part of QUALCOMM's Launchpad™ suite of multimedia technologies, the Q3Dimension solution offers 3D gaming capabilities for all major air interfaces.

The Q3Dimension 3D graphics gaming solution is supported on most Mobile Station Modem™ (MSM™) chipsets. For a complete list, see <http://www.cdmatech.com>.

Graphics Applications Programming Interface

The addition of the Q3Dimension solution to the Launchpad suite adds a variety of fast, robust 3D rendering engines that enable high-performance 3D games, animation, advanced user interfaces and other applications that take advantage of the 3D graphics capabilities of wireless devices. Q3Dimension offers developers access to this functionality through the Q3Dimension application programming interface (API), which is in a familiar BREW® environment based on the

industry standard OpenGL® ES API. By adhering to this industry standard graphics API, developers can quickly port and generate 3D applications to high performance, large volume platforms, using familiar tools and programming models. For easy accessibility, Q3Dimension is supported through the BREW Software Development Kit (BREW SDK™).

Sophisticated gaming content is possible by offering familiar and standardized development tools for easy redeployment of existing content and rapid development of new applications.

Gaming Acceleration

QUALCOMM's robust 3D graphics rendering platforms range from fast digital signal processor (DSP)-accelerated geometry to fully dedicated graphics rendering hardware for 3D geometry and rasterization. These 3D rendering platforms are coupled with select MSM chipset solutions, allowing increased rendering capabilities over previous non-accelerated systems. QUALCOMM has accelerated the geometry and rendering portions of the OpenGL ES Common Light API, a fixed-point API, paying close attention to exact data path and numerical requirements. The result is reduced power consumption, a reduced footprint for games and optimal performance.

Specific chipset platforms that feature Q3Dimension offer three discrete performance levels:

- 150k 3D triangles/sec with 600k 3D textured pixels per second with display support to 176 x 220 resolution
- 225k 3D triangles/sec with 7M 3D textured pixels per second with display support to QVGA resolution
- 4 Million 3D triangles/sec with 133 million 3D textured pixels per second with display support to VGA resolution

The consistency of performance of each discrete performance level across devices that implement different radio interfaces will ease the effort for game developers to create and port games to MSM platforms.

Wireless Applications

The combination of accelerated 3D graphics and the rich multimedia environment provided by the QUALCOMM Launchpad suite of technologies, including advanced multimedia, connectivity, position location and user interface capabilities, offers opportunities for redeployment of existing content as well as development of unique applications and portable content not available on other graphics devices.

Applications supported by the Q3Dimension solution include: 3D screen savers and logos, new user interfaces, 3D messaging, embedded and downloadable games, location-based visual services, navigation visualization, sound visualization, image enhancement, and simple animations such as personal, portable avatars.

Current 3D Features

The Q3Dimension engine and APIs allow developers to perform all basic functions expected in a modern 3D accelerated device; Q3Dimension supports all OpenGL ES Common Light version 1.0 graphics functions in all 3D capable MSM platforms. The highest-performance Convergence Platform Chipsets also support the OpenGL ES Common profile. The following illustrates the rich graphics feature set available as part of Q3Dimension:

- Color buffer format: 16b RGB
- Z buffer depth: 16b Z buffer
- Primitives: vertex arrays, points, lines, triangles
- Projections: perspective, orthographic, viewport scaling
- Standard transformations: translation, rotation, scaling
- Custom transformations: matrix stack, load matrix, multiply matrix, query matrix
- Rasterization: flat and shaded surfaces, face culling, polygon offset, fog
- Lighting: per vertex lighting, including ambient, diffuse and specular components
- Texture depth: 2D, 4b, 8b palletized; 16b-565 RGB, 24b-888 RGB; 16b-5551 and 4444 RGBA, 32b-8888 RGBA, 8b L, 16b LA, 8b A, texture compression
- Texture size: 256 x 256 maximum per texture
- Number of textures: limited only by amount of system memory
- Texture filtering: nearest, bilinear, tri-linear
- Texture wrapping and blending: all OpenGL ES wrapping and blending modes
- Texture manipulation: texture sub-image, copy texture sub-image
- Fragment processing: scissor, alpha, depth test, blending, logical operations
- Color buffer operations: clear to color, read pixels
- Graphics feedback: gets static state queries

All MSM chipset solutions that implement Q3Dimension are completely integrated graphics solutions, which eliminates the need for external graphics coprocessors for achieving high-performance 3D graphics rendering capabilities. With integrated 3D graphics technology, QUALCOMM's chipsets require less printed-circuit-board area than non-integrated solutions, less power, and reduced time-to-market development and bill-of-materials (BOM) costs to achieve comparable 3D graphics performance.

The Launchpad Suite of Technologies

The Launchpad Suite of applications technologies offers wireless operators and manufacturers a cost-effective, scalable and timely solution for providing advanced wireless data services. This seamlessly integrated solution enables advanced next-generation applications and services that incorporate multimedia, position-location, connectivity, customized user interface and storage capabilities. Launchpad allows manufacturers to select from a menu of enabling technologies to create customizable devices for each market segment. Getting all the enabling technologies from one supplier ensures compatibility and makes it cheaper and easier to incorporate the features customers are demanding, at a price they are willing to pay.

Launchpad features drive airtime usage and allow operators to offer handsets from different manufacturers that run identical feature sets, increasing efficiency and reliability. Launchpad features are available for each QUALCOMM chipset, closely matching the specific functionality and cost-target objectives agreed upon in joint product planning with manufacturers and wireless service operators worldwide.

The BREW Solution

QUALCOMM's chipsets also support the Company's BREW ecosystem, which enables the development and monetization of advanced applications and content, allowing operators and OEMs to differentiate their products and services and increase revenues.

QUALCOMM's Complete Solution - Our Commitment to Our Partners

QUALCOMM CDMA Technologies is shaping and creating new ways to communicate. Working with manufacturers and operator partners worldwide, we develop systems that provide the foundation for tomorrow's wireless services while delivering what the market needs today. Our industry-leading CDMA engineers create detailed reference designs to accelerate testing and deployment for our partners. Our chipsets and systems bring advanced features and functionality to legacy and next generation networks and devices. With QUALCOMM CDMA Technologies, manufacturers and wireless operators can deliver the products and services the world wants now and be the first to market with future developments.



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