# ekioh

# UNLOCK THE HIDDEN POWER OF HTML
# WITH FLOW

## The world's first multithreaded HTML5 browser

# Background

The underlying architecture of traditional browsers hasn't changed in the last 25 years despite being an essential component in a wide range of products for both application rendering and web page presentation. Instead, browser evolution has focused upon adding new features and functionality.

When the web was created, desktop computers generally had a single CPU and so naturally browsers were single threaded. Accepted thinking at that time was that processing speeds would double every couple of years ensuring a limitless capacity for increasingly complex web page designs. In many ways, processor performance has more than lived up to those expectations; however, the way this performance is delivered has changed significantly due to the drive for cost and power efficiency.

Today's dual and quad core embedded devices deliver increased headline performance with lower power consumption. Performance leaps are now made by increasing the number of cores whereas previously the focus was solely on incrementing the clock speed which resulted in power hungry, single core devices. Rather than simply maintaining the clock speed, increases in the number of cores are often accompanied by a reduction in clock speed so that, whilst overall performance goes up, the performance of each core reduces.
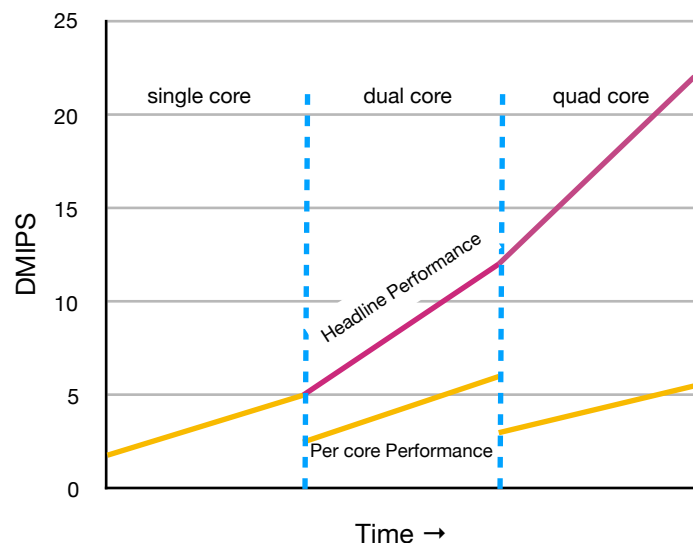
For traditional browsers this presents something of a problem because their single threaded design limits them to use only one of the available cores and hence the majority of the processing power lies idle. Whilst more recent browser developments have sought to make better use of the cores, their primary functions are still single threaded meaning much of the available processing power is wasted.

Virtually all multi-core embedded devices incorporate a GPU. Designed to handle complex graphical operations, GPUs are ideally suited to handle the increasingly rich demands from modern applications but they are often underused. Most browser designs make partial use of the GPU, but they still rely upon the CPU for many graphics functions; this greatly reduces the performance that can be achieved. What's more, as screen resolutions increase, the potential benefit that the GPU can provide will only increase.

What is needed is a totally new browser design to fully exploit the processing and graphical capabilities that modern silicon has to offer.

**flow@ekioh.com    www.ekioh.com**

ekioh

## Introducing Flow

In development since 2012, Flow is a new multithreaded browser that can cut layout times by 60% on a quad core processor. By going back to the drawing board and revisiting every aspect of browser design, Ekioh has developed a clean room architecture which utilises all of the available cores and the GPU to deliver unrivalled performance.
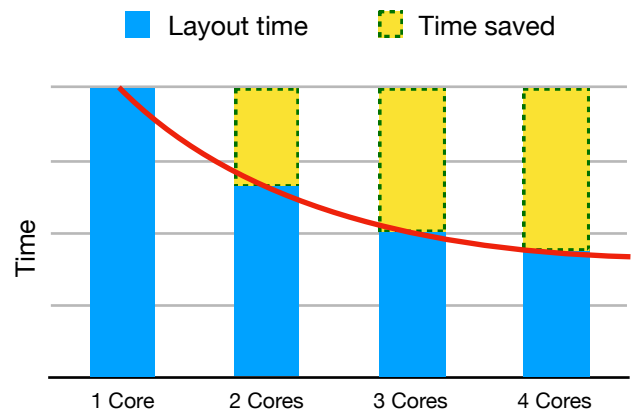
Existing browsers can spend a considerable amount of their time in HTML layout, especially for text-heavy applications and user interfaces. For static web pages, painting accounts for very little of the browser's overall workload, but this rises for highly dynamic UIs. As resolutions increase to 4K, and applications become graphically complex, the painting workload will increase significantly.

Flow's multithreaded layout makes full use of all the available cores to deliver the best possible performance. As core count increases, Flow's layout performance takes another leap upwards. Flow completes the layout tasks in a fraction of the time compared to traditional browsers so, while all the cores are active during layout, this does not impact overall power consumption.
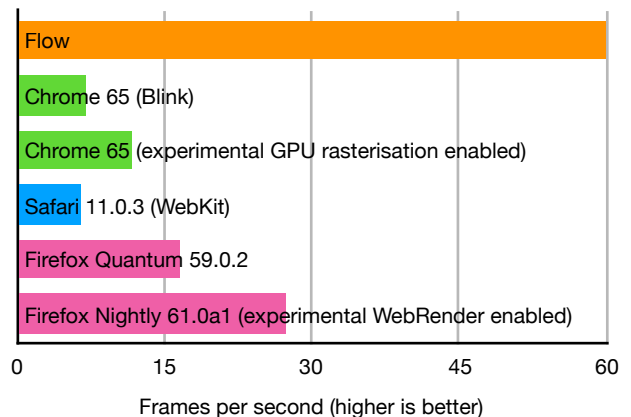
To further increase performance, Flow uses the GPU for all painting operations. In addition to making painting significantly faster, using the GPU for all graphics processing frees the CPU cores making them available for scripting, page layout, and other critical tasks.

Whilst embedded GPU capabilities are not as rich as their desktop counterparts, their evolution forms a large part of modern silicon providers' product roadmaps. Flow is designed to work with both embedded and desktop GPU architectures to maximise the benefit that each has to offer. With each new generation of embedded silicon, GPU performance increases significantly further increasing Flow's rendering performance.

Benchmarking graphically rich applications shows that Flow can be over twice as fast as traditional browsers, even when their experimental performance enhancements are enabled.

**Legend:** Layout time — Time saved

Chart axes: Time (vertical) vs 1 Core, 2 Cores, 3 Cores, 4 Cores (horizontal)

### Flow can be over twice as fast

- Flow
- Chrome 65 (Blink)
- Chrome 65 (experimental GPU rasterisation enabled)
- Safari 11.0.3 (WebKit)
- Firefox Quantum 59.0.2
- Firefox Nightly 61.0a1 (experimental WebRender enabled)

Frames per second (higher is better): 0, 15, 30, 45, 60

flow@ekioh.com     www.ekioh.com

ekioh

Flow is built upon the latest open standards from WHATWG and the W3C enabling developers to benefit from a wide range of third party tools. Because of this standards based approach, there is no need to re-author existing HTML applications to take advantage of Flow's performance benefits.

To aid development and optimisation of new HTML applications, Flow includes inbuilt debug and profiling tools. Selenium WebDriver is also supported enabling automated testing at both the unit and system level.

Ekioh has been designing and developing user interface and browser solutions for over ten years. Well known for its high performance, low footprint solutions Ekioh has helped operators deploy tens of millions of products in over 30 countries around the world. The knowledge and experience gained from these deployments provides the foundation of expertise that underpins Flow's clean room design.

To find out more, or to arrange a preview, please contact Ekioh at: flow@ekioh.com



## About Ekioh

Ekioh designs and develops rendering software for a wide range of consumer products and resource constrained platforms. The company's products provide the high performance, compact footprint and flexibility necessary to address the wide range of application and UI rendering challenges presented by the consumer electronics and embedded systems industries. Best known for its TV and set top box solutions, Ekioh technology forms the basis of the fusion of traditional media and over the top content in many of the world's most successful television networks.

Ekioh's engineering team brings together expertise in graphical systems, embedded software, set top box, TV silicon and robust software design. Using this combination of skills, fuelled by intense customer focus, Ekioh's product quality and customer support are second to none.

flow@ekioh.com     www.ekioh.com

ekioh