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BrainChip

The Possibilities Are Limitless

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PRESENTATION
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Spiking Neuron Adaptive Processor (SNAP) Overview



- Autonomous learning - BrainChip's SNAP technology learns autonomously, evolves and associates information, and responds to stimuli like a human brain.
- A unique Neural based architecture - SNAP replicates the neural behaviour of a biological brain.
- Lightning speed - SNAP operates at more than 5000x faster than a supercomputer.
- Low power consumption - SNAP uses just 1/1000th of the power consumption current generation cognitive computer technology.
- Unique and patented - SNAP is the world's only autonomous learning technology, patented in the USA and Australia with an early priority date of 2008.
- A hardware only solution - SNAP has no software or computer programming.
- Validated by pre-eminent Neuroscientists - Including Kavli Institute, University of California San Diego (USCD), University of Western Australia (UWA).
- SNAP provides a solution to a wide range of currently insolvable problems.

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The BrainChip's Difference



- A completely new architecture design - recognises the HUGE differences between computer architecture and the brain's architecture.
- SNAP biomimics the human brain - learns and associates like the human brain.
- SNAP's learning algorithm is a triple-pulse Synaptic Time-Dependent Plasticity (STDP) model, adapted to respond to the repetition and intensity of input streams.
- Learned events are stored in a patent pending knowledge library - SNAP learns from usage patterns and evolves learning through experience. Like the biological brain these "experiences" are accumulated and stored in its knowledge library.
- No loss of performance - SNAP experiences no loss of performance when executing complex tasks.

*Learning and training takes the place of programming and coding.
Like a child learning a task for the first time.*

Patent Pending - Knowledge Library



- BrainChip's knowledge library architecture will make it possible to connect multiple BrainChips to form huge arrays.
- A co-processing solution - BrainChip is designed with a microprocessor interface, making it possible to read and back up knowledge. This also facilitates the creation of function or learning libraries to store BrainChip's "experiences".
- These functions can then be knitted together to provide innate knowledge to a centralised microprocessor.
- BrainChip never stops learning but is defined by the number of neurons that exist within each chip. It will continue to learn and develop increasingly complex functions. This unique capability provides a pathway for increasingly intelligent BrainChip systems.

"BrainChip is a technology platform that has the same architecture as a biological brain.

It combines the same parallel processing capability with its learning abilities"

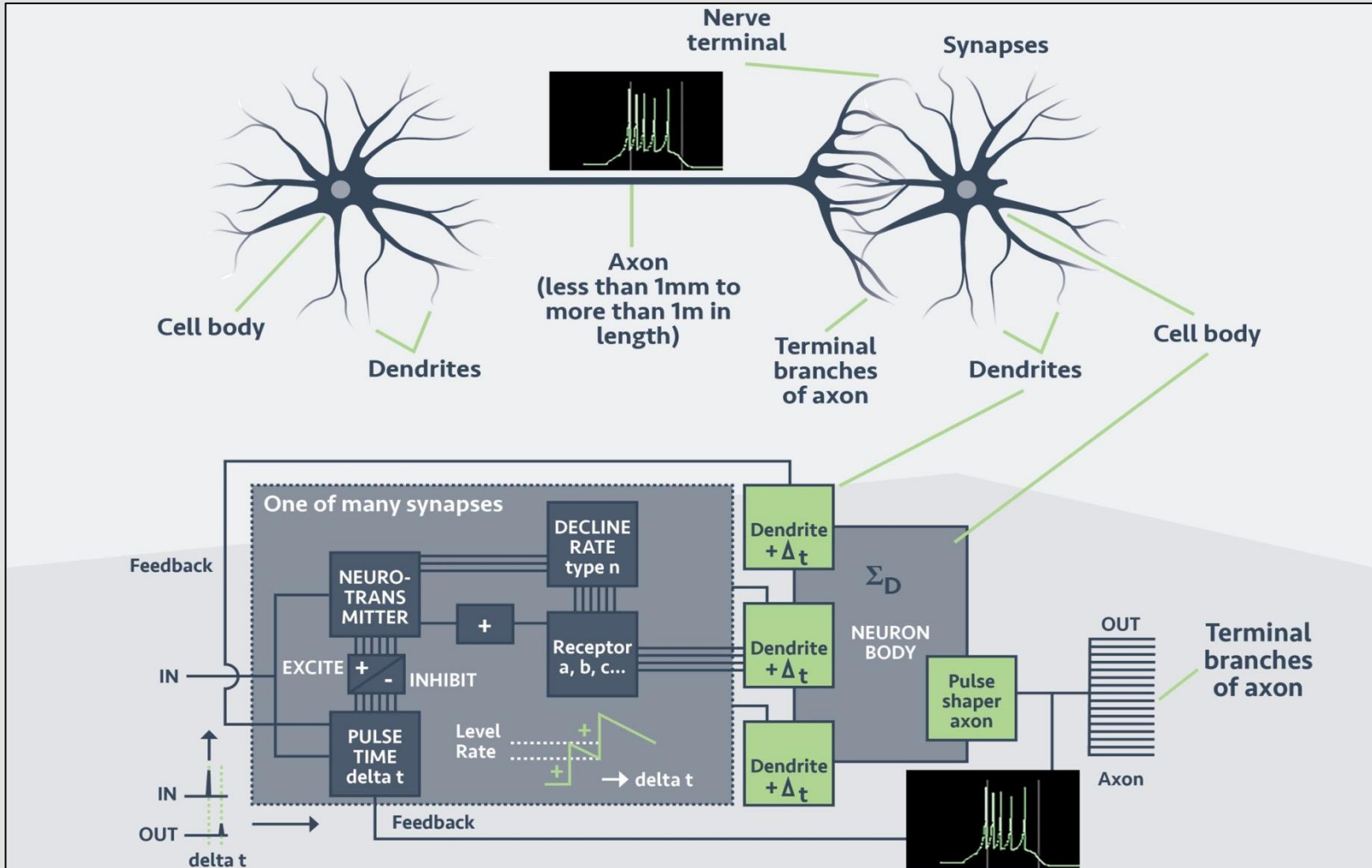
Peter Van Der Made

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BrainChip Artificial Neuron and Biological Neuron Function



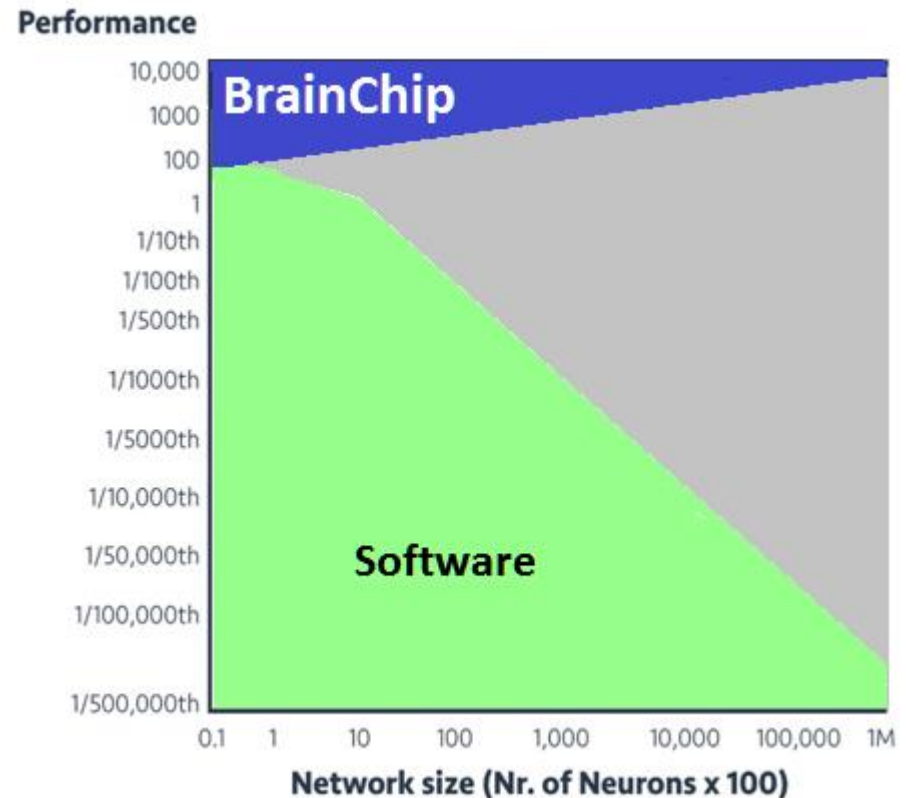
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BrainChip's Hardware is Superior to Software



- A hardware only solution - SNAP has no software to impair its performance.
- The SNAP performance advantage increases with more complex tasks.
- Large networks can be created by using multiple devices.
- Autonomous learning solution that mimics the learning process of the brain.



*The larger the network the greater the performance advantage
Compared to computer software*

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Hardware Only Design - Unique Benefits



| BrainChip Hardware Neurons | Software Neural Networks |
|---|---|
| All at once evaluation | Sequential evaluation - one at a time |
| Massive parallel processing | Sequential processing |
| Unlimited number of neurons | Limited by CPU clock speed of processing cores |
| Sustained high performance independent of size | Speed depends on network size |
| Faster by 3-4 orders of magnitude. No size dependencies | Decline in network performance with size |
| Extremely low power consumption | Power consumption - 4 orders of magnitude higher than BrainChip |
| Fast STDP learning - learns like a brain learns | Slow generic algorithm or back propagation learning algorithm |

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Milestone 1 – SNAP Software Simulation



Milestone 1

“Simulating a race car demonstration in software for “proof of technology” by comparing BrainChip’s SNAP technology to a traditional Sigmoid (software) or genetic learning algorithm technology. Establishes the technology works and is clearly superior in its learning ability and speed.

| Goal | Achieved |
|-----------------------|-----------------|
| Superior speed | ✓ |
| Ability to learn | ✓ |
| Low power consumption | ✓ |

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Milestone 2 – Hardware Demonstration (Scalability)



Milestone 2

“Implementing a race car demonstration in hardware to visually illustrate the capability and scalability of BrainChip’s SNAP technology to prospective licensees. Performs the same function as the software model but in hardware. Will be many times faster. Test ground for the future client/server tools and the application programming interface (API)”.

- Milestone 2 will show BrainChip has increased the number of neurons it can put onto a chip from the prototype.
- Proven scalability will show that SNAP can upgrade to suit more complex tasks.
- Proving Milestone 2 will mean that it is able to suit the requirements of any potential partners.

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Milestone 3 – Client Server Application



Milestone 3

“Release a software API specification and RTL design solution for implementing customer Client/Server neural network applications using the SNAP hardware technology. Makes it possible for clients to develop their own solutions on top of the BrainChip hardware.”

- This will allow the SNAP technology to be installed on a clients/partners own server so their people can utilise and discover the technology.
- Will give rise to many applications from the work they will be able to carry out.
- Once the SNAP technology has been learned by the client/s the number of technology products could increase significantly. BrainChip will receive licencing fees, engineering fees, and royalties on all products created.

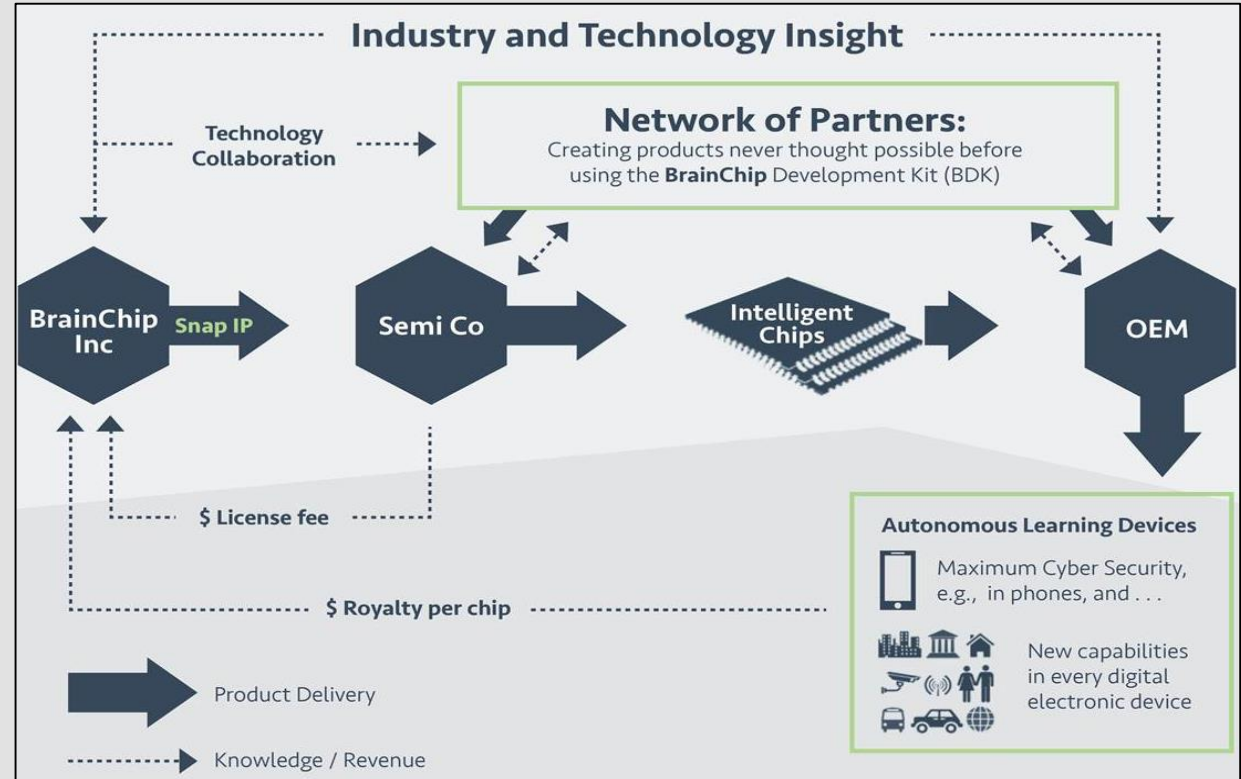
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Creating Value - The BrainChip Business Model



- Licensing and Non Recurring Engineering (NRE) Fees**
 - Partners and semiconductor companies design and manufacture a chip utilising SNAP.
 - One off NRE fee for research, design, testing and implementation.
- Royalties**
 - BrainChip anticipates receiving a royalty for every chip sold containing SNAP, typically based on a percentage of chip price.
 - Potential for multiple income streams if customers re-use same technology in different chips going into different end markets.
- BrainChip Development Kit (BDK)**
 - Available to the public to develop bespoke applications.
 - Opens doors to limitless licensing and royalties revenue.



Potential Applications



- Anything with a microprocessor can take advantage of SNAP.
- Whatever the application SNAP will further its capabilities, enhance user experience, and improve performance.
- BrainChip's growth will be driven by companies realising how SNAP can create new opportunities for current and yet to be discovered applications.
- Semi-conductor industry is an enormous market that has spent years seeking a technology that has the capabilities of SNAP.



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Summary



- A hardware only solution - SNAP is a hardware based solution that through learning like a biological brain eclipses the current software driven alternatives.
- Patented and validated - SNAP is patented and has been validated by pre-eminent neuroscientists.
- Commercialisation underway - Milestone 1 achieved ahead of schedule. Proves speed, learning and low power consumption.
- Work in progress - Milestone 2 will put SNAP on the radar screens of global technology and semi-conductor companies.
- A targeted approach to early commercialisation - BrainChip's initial markets are high volume, low risk and offer potential for significant income.
- SNAP is showing it has the potential to be the de facto standard for all neural computing.

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