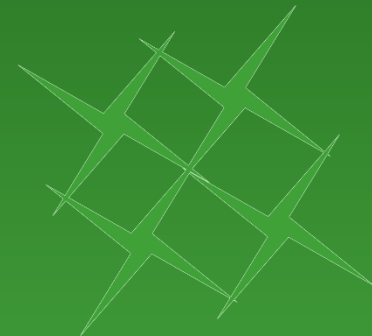


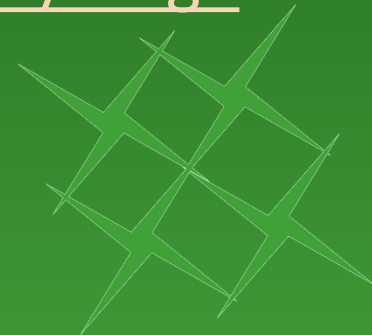
Forth Day: Green Arrays, Inc.

- Greg Bailey
 - Intro: The State of Green Arrays
- Stefan Mauerhofer
 - Eval Board Application: Low Frequency Clock and UART
- John Rible
 - Roots and other Memories
- Mangpo Phitchaya Phothilimthana
 - Synthesis-Aided Compiler for Green Arrays
- Charley Shattuck
 - Building Boot Streams
- Chuck Moore
 - Fireside Chat



For More Information on GreenArrays

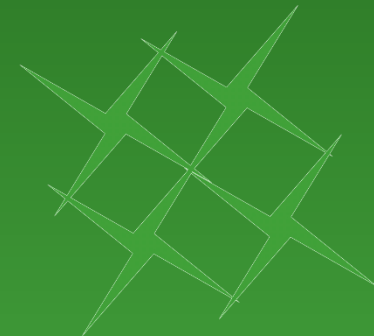
- Primary Website
 - <http://www.greenarraychips.com>
- arrayForth Institute
 - <http://school.arrayforth.com>
- Announcement Blogs
 - Business <http://www.greenarraychips.com/blog1>
 - Technical <http://www.greenarraychips.com/blog2>
- Tech Support on e-mail, Skype, Phone





Building Boot Streams

Charley Shattuck



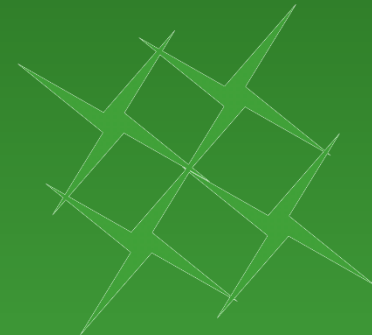
Boot Protocol

- Three Word Header
 - Completion (jump) Address
 - Transfer (store) Address
 - Transfer Size in Words
- Followed by Data Words
 - Focusing Call
 - Body of Boot Stream
- Documented on the Green Array website...
- <http://www.greenarraychips.com/home/documents/greg/BOOT-02.pdf>



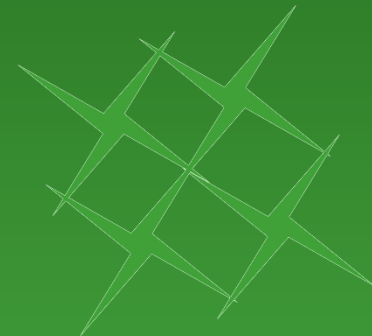
Boot Frame vs Boot Stream

- A frame has one header, streams the specified number of words to the specified address, then resumes execution at the continuation address. Can send data to either RAM in the root node or to a port, but not both.
- A stream may contain multiple frames. If code/data are destined for the root node, a separate frame is appended after the rest of the chip has been loaded.



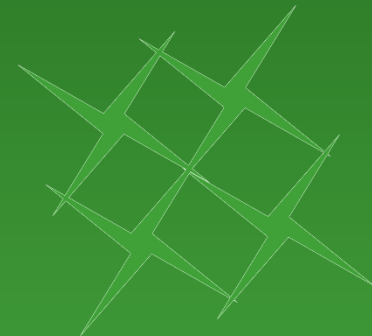
Boot Path

- `brdg align create 708 700 to 600 300 to -1 , brdg course`
- Make a list of nodes to be visited by the boot frame
- Traverse the list applying boot descriptors
 - `/a /b /io /p /part /ram /stack /rstack`



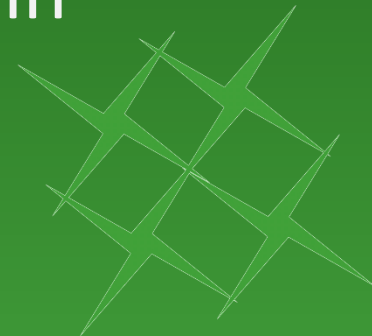
Boot Frame Header

- Each Boot Node has code in ROM that reads in three 18 bit words when boot conditions met
 - 1. Address to jump to when boot frame complete
 - Can be an address in just-loaded RAM, ROM, or a port
 - 2. Destination address for incoming data
 - Can be RAM in boot node or a port
 - 3. Number of words to be transferred
 - Exact number, zero means none



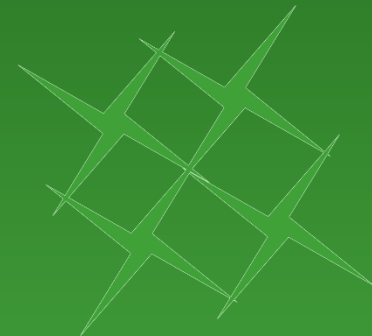
Node's Eye View

- Sitting at WARM
- Receive a focusing call from earlier neighbor in boot path
- Receive a port pump, become a wire for nodes later in the boot path
- Optionally receive a load pump and load RAM
- Initialize registers and jump to address in RAM, ROM, a PORT or back to WARM



Boot Frame Body

- First word is focusing call
- Executable code follows which moves code along a path across the chip
- Move code and data via a Port Pump
- Load code and data into RAM via a Load Pump
- Initialize registers according to Boot Descriptors in Post



Port Pump

- All but the last node in a path
- Five Instruction Words
 - @p dup a! @p
 - Call to Port Address
 - Word Count - 1
 - push ! ..
 - @p ! unext ..
- Port Pumps are set up for every node in the path, except the last



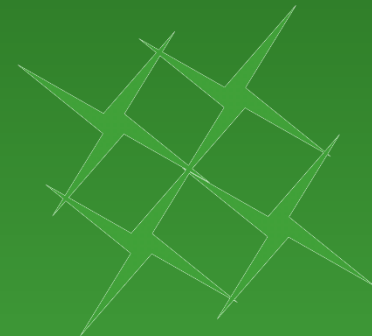
Load Pump

- Optional
- Five Instruction Words
 - @p a! @p ..
 - Port Address
 - Word Count - 1
 - push ..
 - @p !+ unext ..
- As we work our way back on the path toward the root node, load pumps initialize RAM in specified nodes



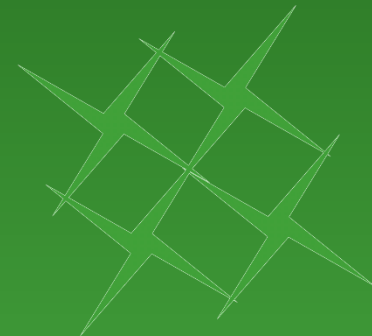
Post Initialization

- Not optional, always..
 - Load address into B register
 - address of IO by default
 - Jump to program entry point in RAM or ROM
 - WARM by default
- Also optionally Initialize
 - IO register
 - A register
 - stacks



For More Information on Building Boot Streams

- Documentation on website
 - Paper: Boot Protocols
 - DB004: arrayForth User's Manual
 - Blocks 240 through 248 of arrayForth





Thank You!

For more information, please visit

<http://www.greenarraychips.com>

