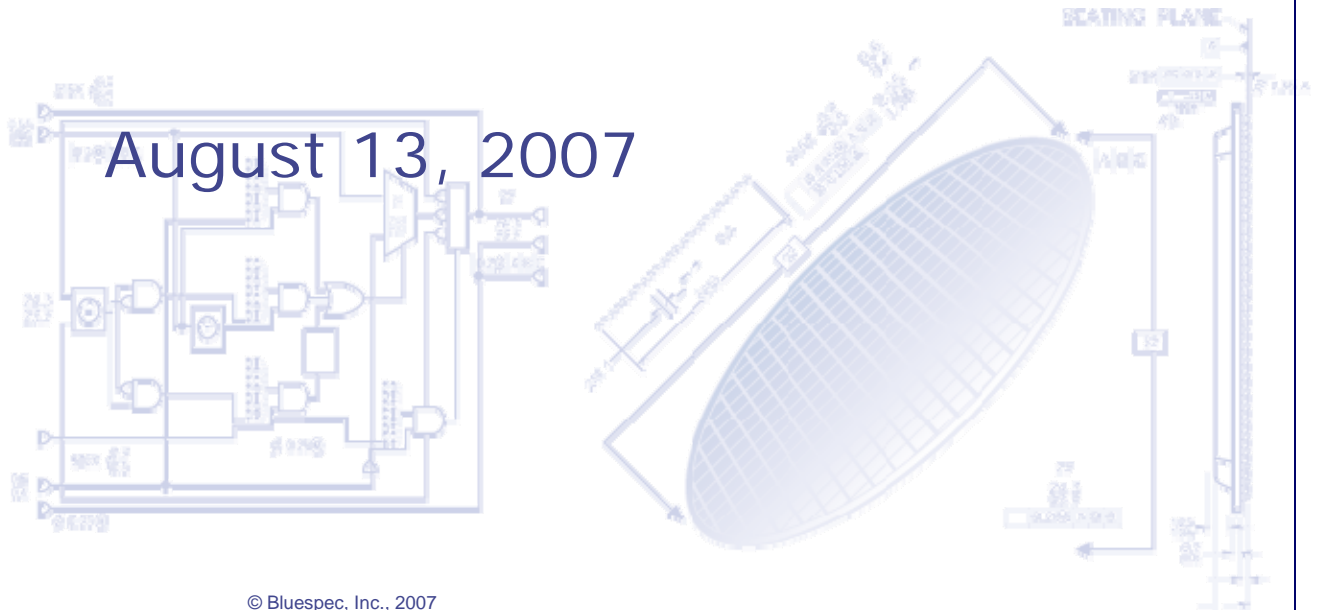




Bluespec Runtime Debugging

New Capabilities and Future Direction

August 13, 2007



Bluespec Runtime Debugging - Goals

- ❑ Transaction-Level Debugging View
 - Match transaction-level design view
 - Provide symbolic representations of signals/data structures
 - Allow viewing through \$display
 - Allow viewing as waves
- ❑ BSV Source-Level Debugging View
 - Debugging view relates signals to BSV source code
 - Provides view of elaborated **BSV** Hierarchy
 - Rules Are Special
- ❑ Simulator/Flow Agnostic
 - Works with Bluesim
 - Works with Verilog Simulation

Added Bluespec Features/Capabilities: **Fmt** Primitive Type (Beta, 08-2007 Release)

- ❑ Represents list of arguments to **\$display** family of system tasks
- ❑ Created with new **\$format** BSV system task
 - Takes same arguments as **\$display** etc
 - Returns object of type **Fmt**
- ❑ Can be concatenated
- ❑ Valid argument to **\$display** family of system tasks (including itself)
- ❑ Ideal building block for dynamic **show** class
 - Generates **ASCII** representation of objects at runtime

Added Bluespec Features/Capabilities: **Fmt** Primitive Type (Beta, 08-2007 Release)

```
function Fmt fshow (TLMResponse#(TLM_TYPES) op);  
    return ($format("<TRESP [%2d] ", op.transaction_id)  
        +  
        fshow(op.status)  
        +  
        $fomat(" %8h>", op.data));  
endfunction
```

```
rule show_resp;  
    resp0 <- rx.get;  
    $display("[%5d] Response is: ", $time, fshow(resp0));  
endrule
```

Symbolic **\$display** output created using **Fmt** Primitive Type

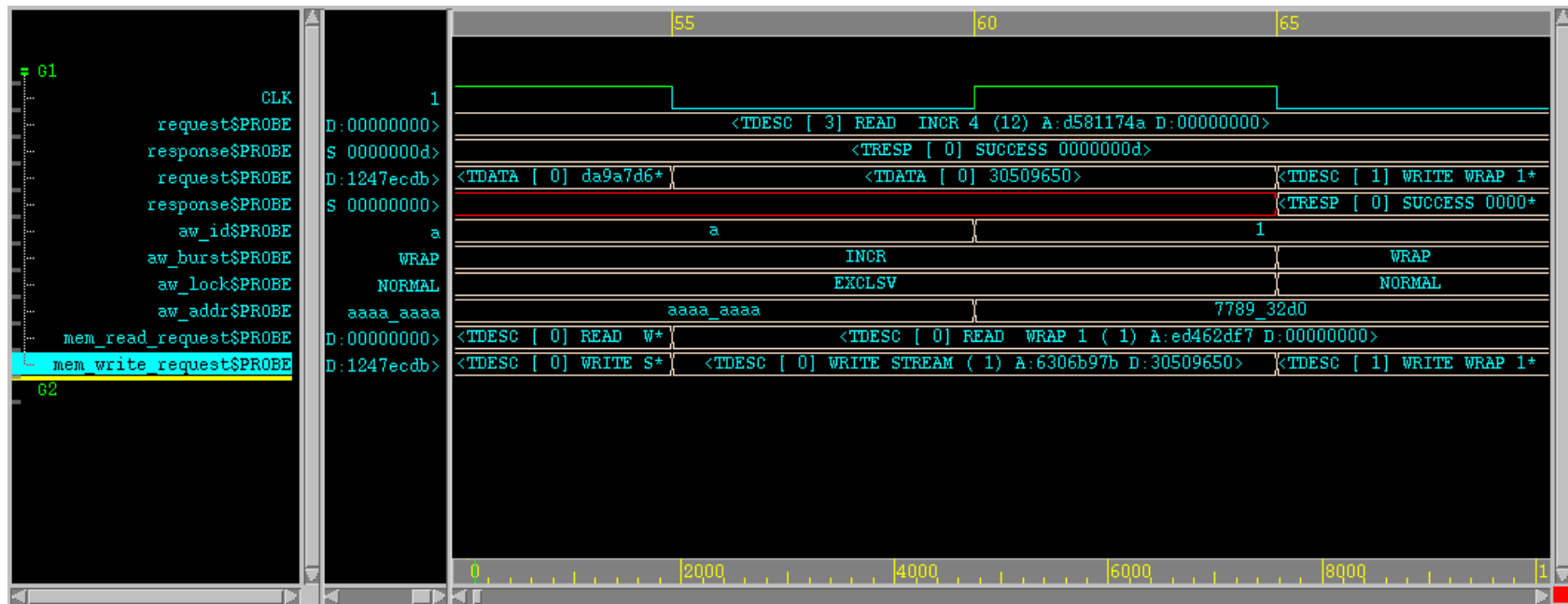
```
>  
> [ 15] Request is: <TDESC [ 0] WRITE STREAM ( 5) A:6306b97b D:0d46df99>  
> [ 15] Request is: <TDESC [ 0] READ WRAP 1 ( 4) A:ed462df4 D:00000000>  
> [ 25] Request is: <TDATA [ 0] 18484d60>  
> [ 25] Request is: <TDESC [ 1] READ STREAM (14) A:e8e2ca4e D:00000000>  
> [ 35] Request is: <TDATA [ 0] 30573870>  
> [ 35] Request is: <TDESC [ 2] READ INCR 1 ( 1) A:20557845 D:00000000>  
> [ 35] Response is: <TRESP [ 0] SUCCESS 0000000d>  
> [ 45] Request is: <TDATA [ 0] da9a7d65>  
> [ 45] Request is: <TDESC [ 3] READ INCR 4 (12) A:d581174a D:00000000>  
> [ 45] Response is: <TRESP [ 0] SUCCESS 0000000d>  
> [ 55] Request is: <TDATA [ 0] 30509650>  
> [ 55] Response is: <TRESP [ 0] SUCCESS 0000000d>  
> [ 65] Request is: <TDESC [ 1] WRITE WRAP 1 ( 8) A:778932d0 D:1247ecdb>  
> [ 65] Response is: <TRESP [ 0] SUCCESS 0000000d>  
> [ 65] Response is: <TRESP [ 0] SUCCESS 00000000>  
>
```

Added Bluespec Features/Capabilities: **\$swrite** family of system tasks (08-2007 Release)

- ❑ Part Of Verilog 2001 LRM
- ❑ Analogous to **\$fwrite** system tasks
 - Except **ASCII** output is now written to variable or state element
 - In BSV a function call of type **Action**
 - **ActionValue** versions available as well
- ❑ Allows viewing of **Fmt** objects as waves

```
rule show_resp;  
    resp0 <- ifc0.get;  
    let ascii0 <- $swriteAV(fshow(resp0));  
endrule
```

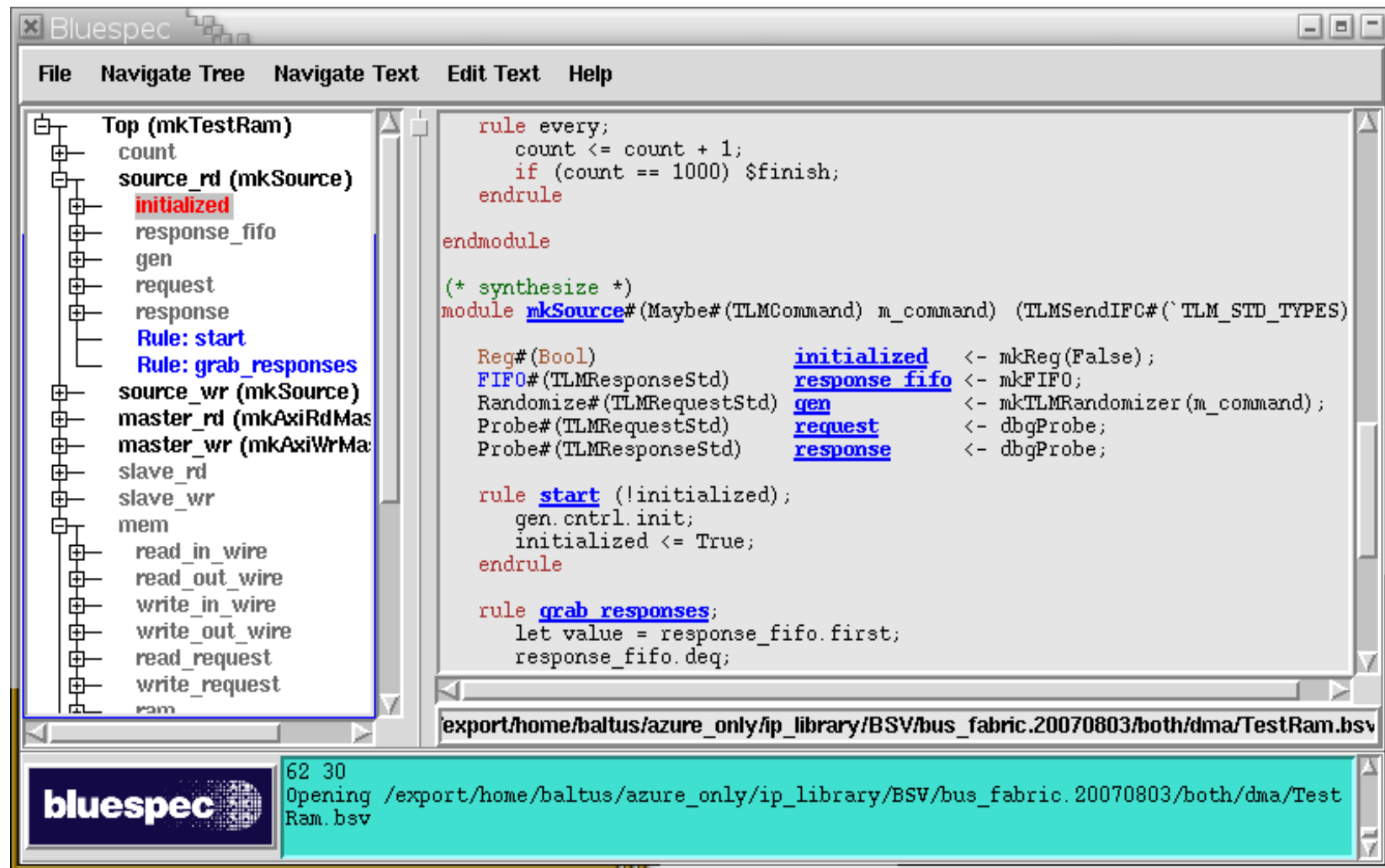
Symbolic waveforms created using **Fmt** primitive type and **\$swrite**



Added Bluespec Features/Capabilities: BSV Source-Level Debugging View (Beta, 4Q 2007)

- ❑ Generates Navigation Tree Based on BSV Hierarchy
 - Both Synthesized and Non-Synthesized Modules
 - Includes Rules in hierarchy as well
- ❑ Hyper-Links To BSV Source Code
 - Modules Instantiations/Rules
- ❑ Rule Firing Visualization
- ❑ Waveform Viewer Integration
 - Synthesized Module Ports
 - Rule WILL_FIRE/CAN_FIRE Signals
- ❑ Works For Both Bluesim and Verilog Flows
 - Links to Verilog For Verilog Flow

BSV Source Code Debugging View: Navigation Tree and BSV Source



Added Bluespec Features/Capabilities: Automatic Derivation Of Dynamic Show Class

- ❑ Automatic Derivation of **Fmt** Representation
 - Implemented as **Format** typeclass
- ❑ Allows User To Write There own As Well
- ❑ Eliminates Need For Special **provisos**

```
typeclass Format#(type t)
  function Fmt format(t value);
endtypeclass
```

Bluespec Runtime Debugging Enhancements Roadmap

- ❑ Add **\$swrite** family of system tasks
 - 08-2007 Release
- ❑ Add **Fmt** primitive type
 - Beta – 08/2007 Release
 - 4Q 2007
- ❑ BSV Source-Level Debugging View
 - Beta - 4Q 2007
 - Integrated with Bluespec Workstation – 1Q 2008
- ❑ Automatic Deriving Of Dynamic Show Class
 - 4Q 2007