=>

0

Advancing Time

- ChucK time stands still until you “advance” it
- two semantics for advancing time
  - chuck to now
    `1::second => now;`
  - wait on event
    `event => now;`
- you are responsible for keeping up with time
- timing embedded in program flow
- time == sound

1

Concurrency

- implemented using “shreds”
  - resemble non-preemptive threads
- automatically synchronized by time!
- possible to easily write truly parallel, sample-synchronous audio code
- can work at low and high level
  - fine granularity == power and control
  - arbitrary granularity == flexibility and efficiency
- a solution to the control-rate issue

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ChucK Virtual Machine

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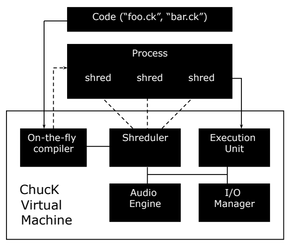
ChucK Virtual Machine



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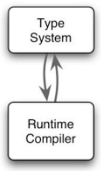

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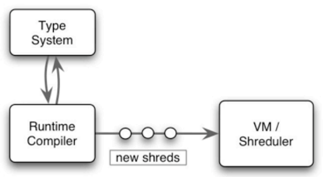
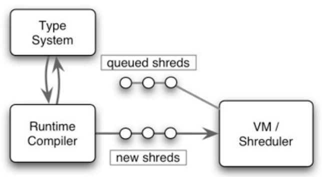
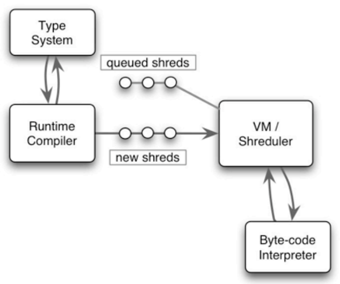

Type System
Runtime Compiler
new shreds
VM / Shreduler

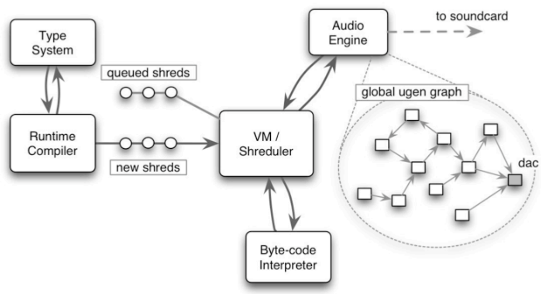
6


Type System
queued shreds
Runtime Compiler
new shreds
VM / Shreduler

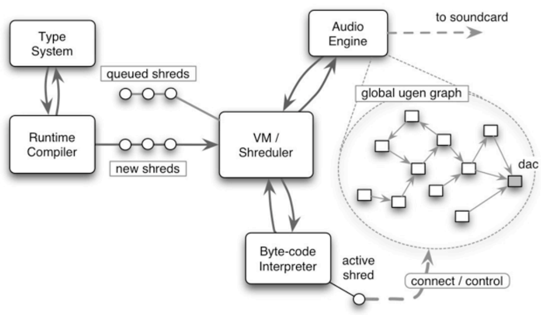
7


Type System
queued shreds
Runtime Compiler
new shreds
VM / Shreduler
Byte-code Interpreter

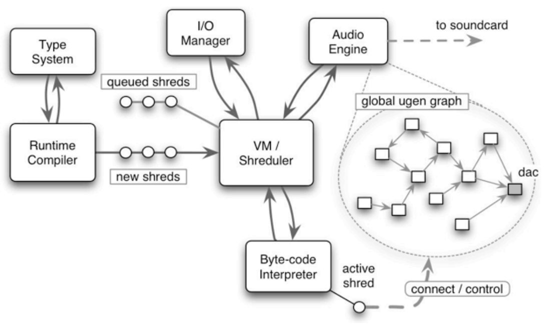
8


Type System
queued shreds
Runtime Compiler
new shreds
VM / Shreduler
Byte-code Interpreter
Audio Engine
to soundcard
global ugen graph
dac

9


Type System
queued shreds
Runtime Compiler
new shreds
VM / Shreduler
Byte-code Interpreter
Audio Engine
to soundcard
global ugen graph
dac
active shred
connect / control

10


Type System
queued shreds
Runtime Compiler
new shreds
I/O Manager
VM / Shreduler
Byte-code Interpreter
Audio Engine
to soundcard
global ugen graph
dac
active shred
connect / control

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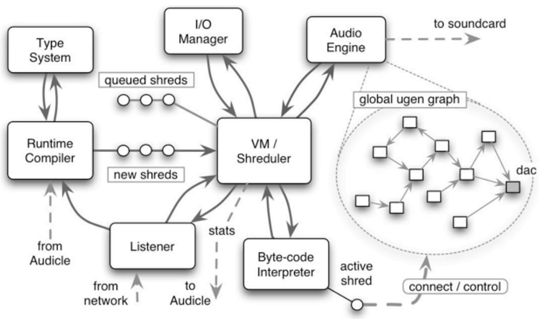

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Virtual Machine

- Bytecode interpreter
  - 100+ ChucK bytecode instructions
- Shreduler
  - User-level non-preemptive shreduling
  - Uses timing and event information
  - Coordinate interpreter with audio computations

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Multi-Shredded Shreduling Algorithm

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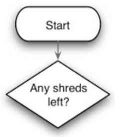

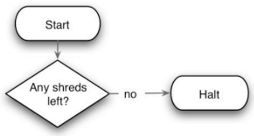

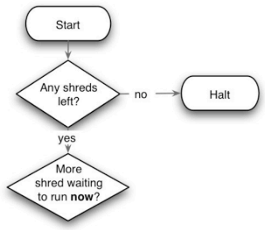

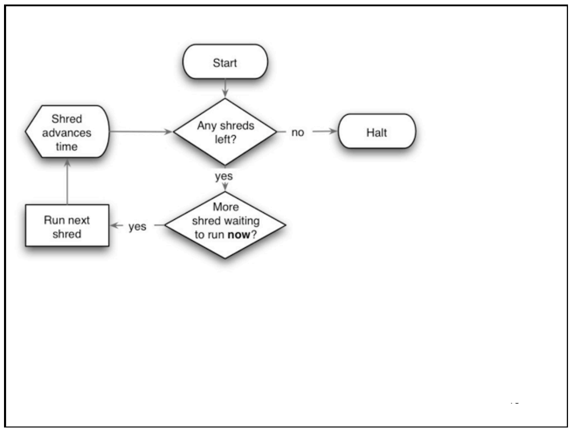

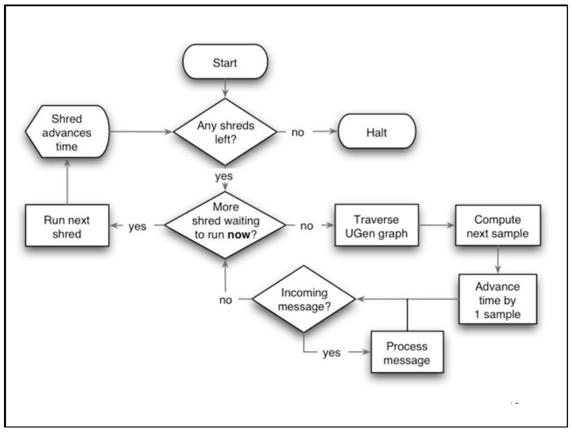

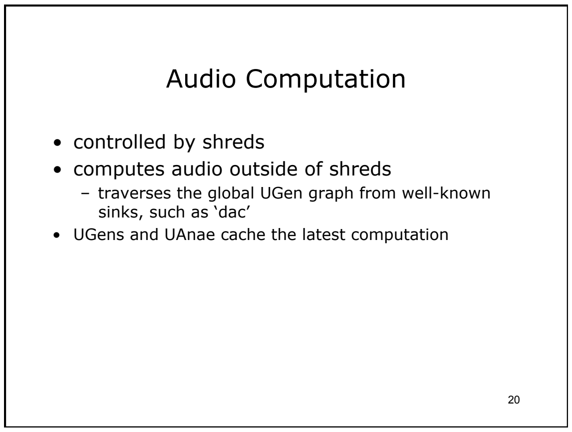

Audio Computation

- controlled by shreds
- computes audio outside of shreds
  - traverses the global UGen graph from well-known sinks, such as ‘dac’
- UGens and UAnae cache the latest computation

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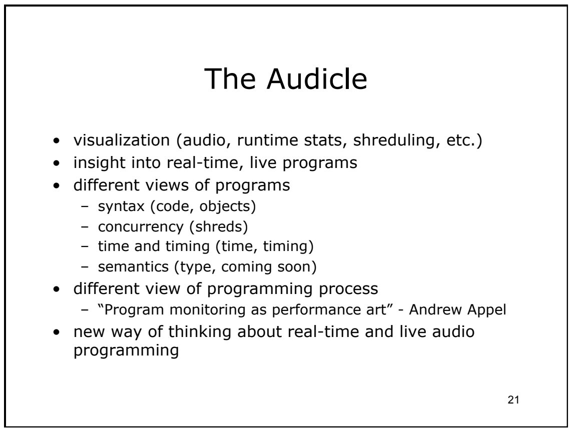

The Audicle

- visualization (audio, runtime stats, shreduling, etc.)
- insight into real-time, live programs
- different views of programs
  - syntax (code, objects)
  - concurrency (shreds)
  - time and timing (time, timing)
  - semantics (type, coming soon)
- different view of programming process
  - “Program monitoring as performance art” - Andrew Appel
- new way of thinking about real-time and live audio programming

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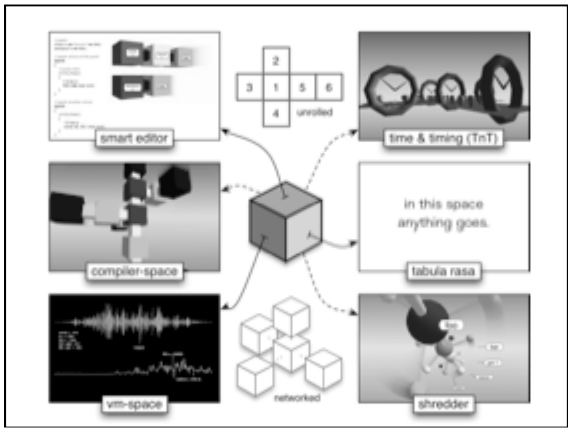
smart editor
2
3 1 5 6
4
unrolled
time & timing (TnT)
compiler-space
in this space anything goes.
tabula rasa
vm-space
networked
shredder