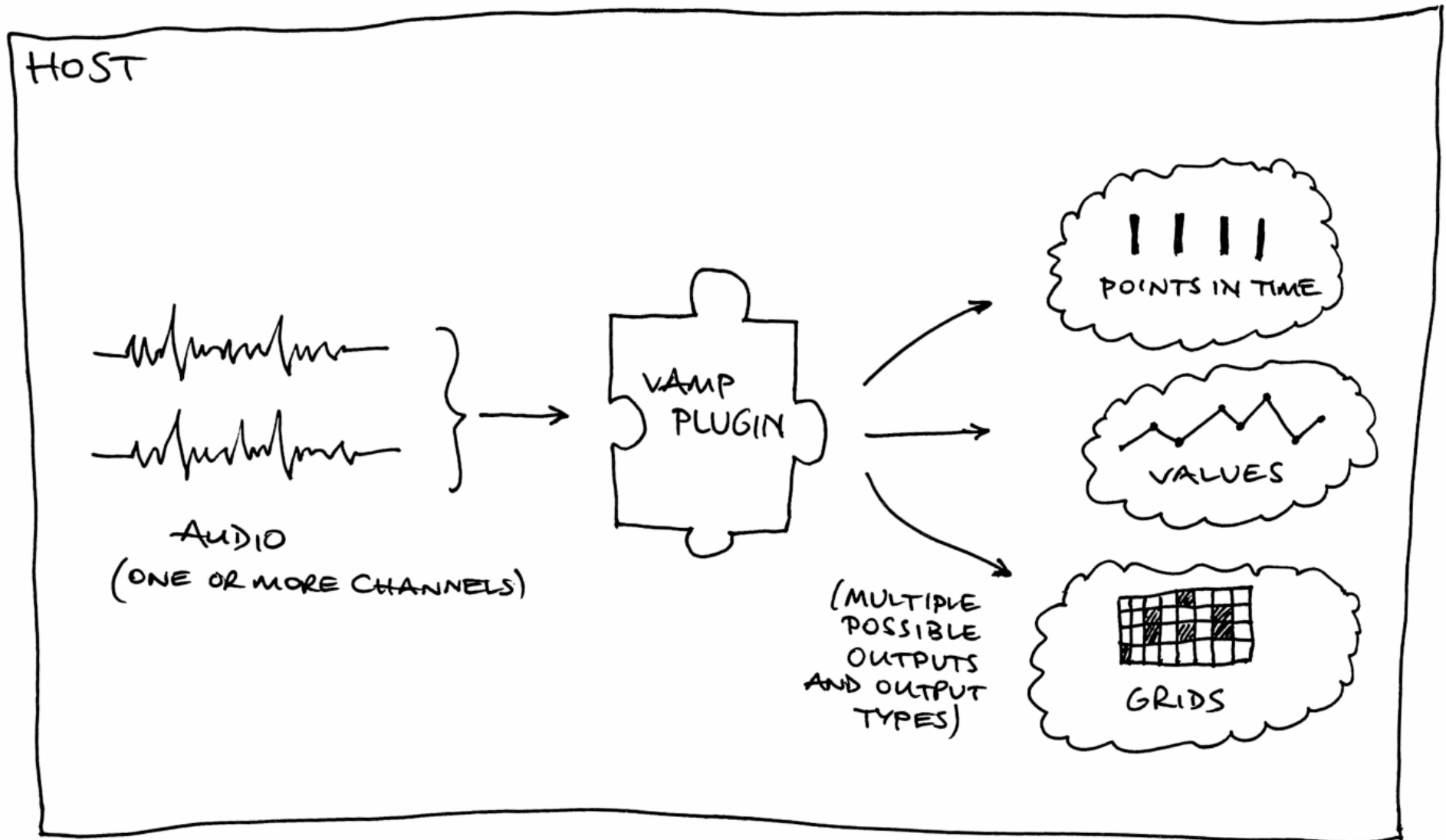


# Vamp plugins

- Chunks of compiled program code delivered in shared library files (DLLs), which can be loaded and used by a compatible host
- Extract partially structured data (“features”) from audio input
- No display or interaction, just calculation
- Examples – note onset detector, chromagram value calculation, amplitude tracker
- Vamp is not an acronym

# A Plugin in its Natural Habitat



# Philosophical notes

- Nothing very clever about Vamp; it just fills a need
- Much drawn from existing audio processing APIs
- Complications mostly from the fact that a plugin may legitimately want to return almost anything
- Classic data description problem:
  - How far do the plugin and host need prior mutual understanding about the meanings of the data being returned?
  - Where to draw the line between “a fixed set of possible feature types” and “anything at all”?

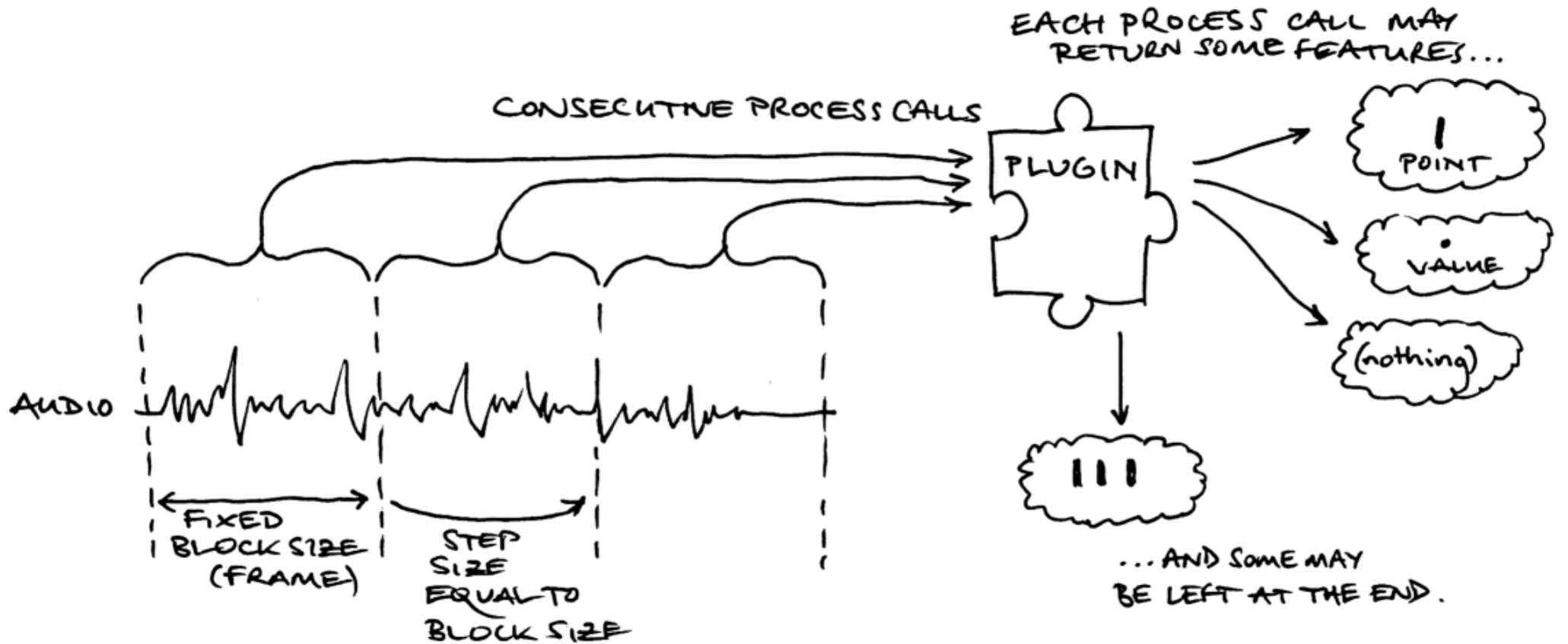
# Things a Plugin May Need

- *Always*
  - Basic descriptive data:  
Identifier, name, description, maker etc
  - Processing preferences:  
Input domain, step size, block size, channel count
  - Output descriptors
  - `process` and `getRemainingFeatures` methods
- *Sometimes*
  - Parameters: descriptors, get and set methods
  - Programs: list of names, get and set methods

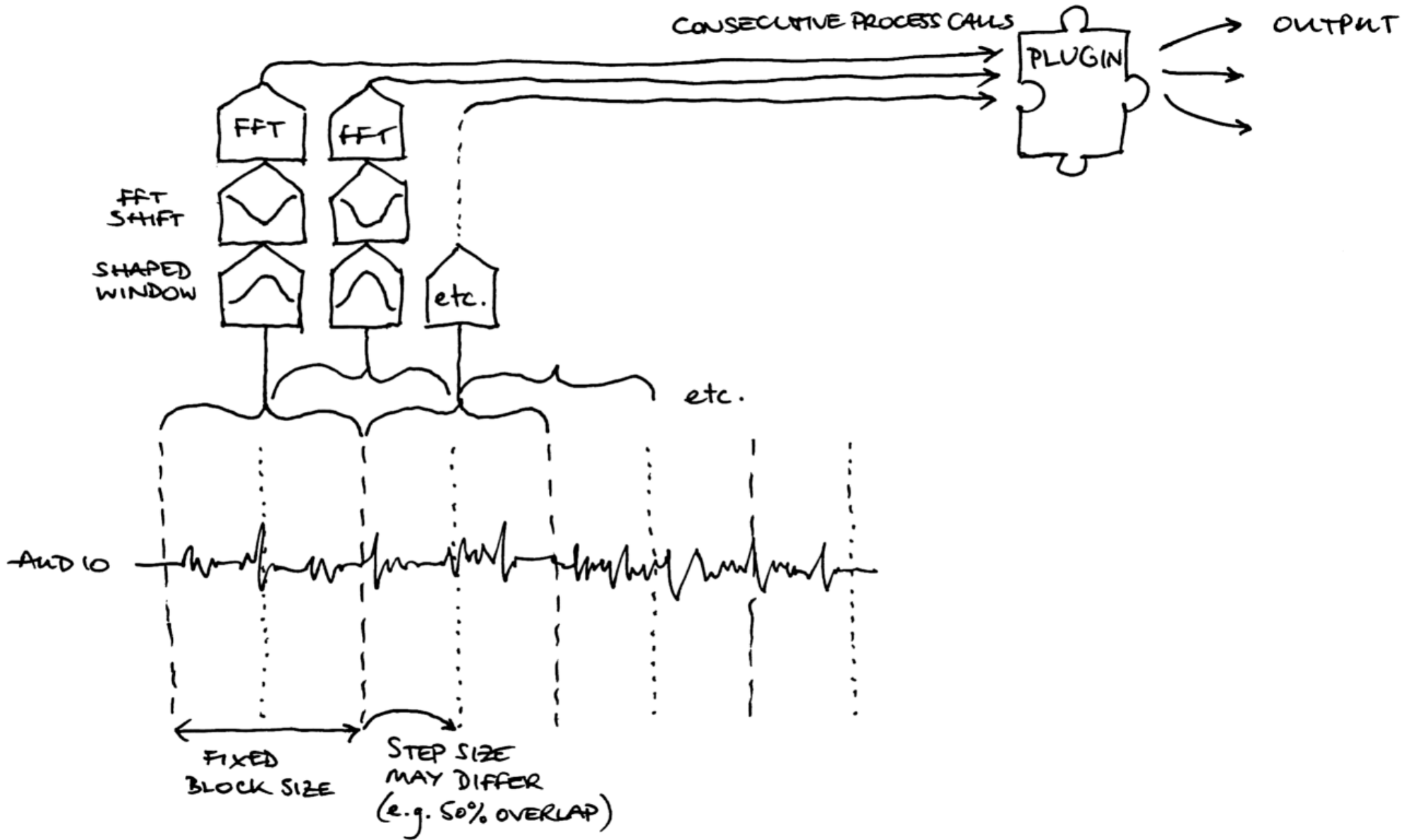
# Plugin Lifecycle

1. Plugin library loaded
2. Plugin object constructed, with sample rate
3. Host queries: outputs; preferred input step & block size, domain, channel count; parameters & programs
4. Parameters and programs set
5. Plugin initialised with step & block size, channels
6. Repeated calls to process
7. One call to `getRemainingFeatures`

# Processing - time domain input



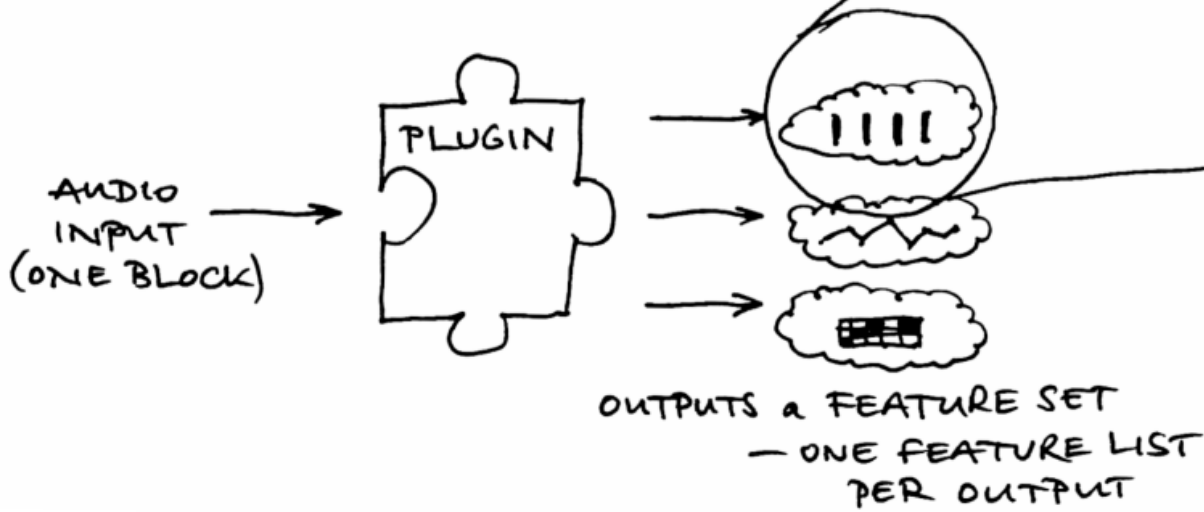
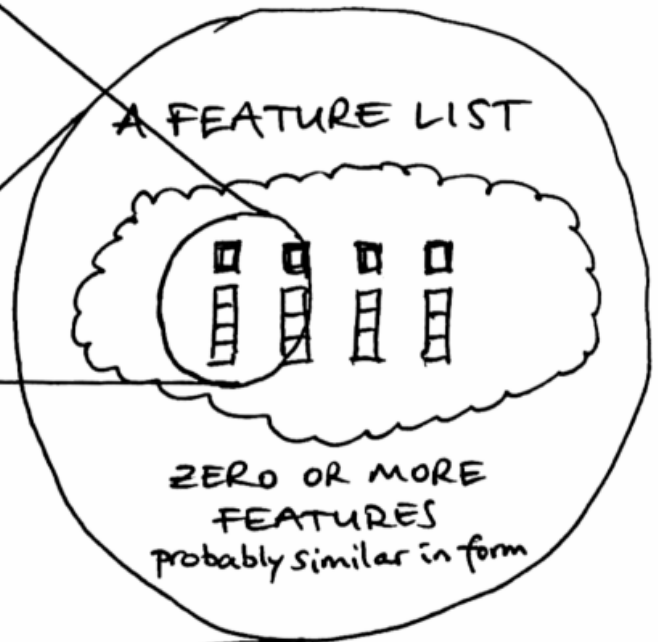
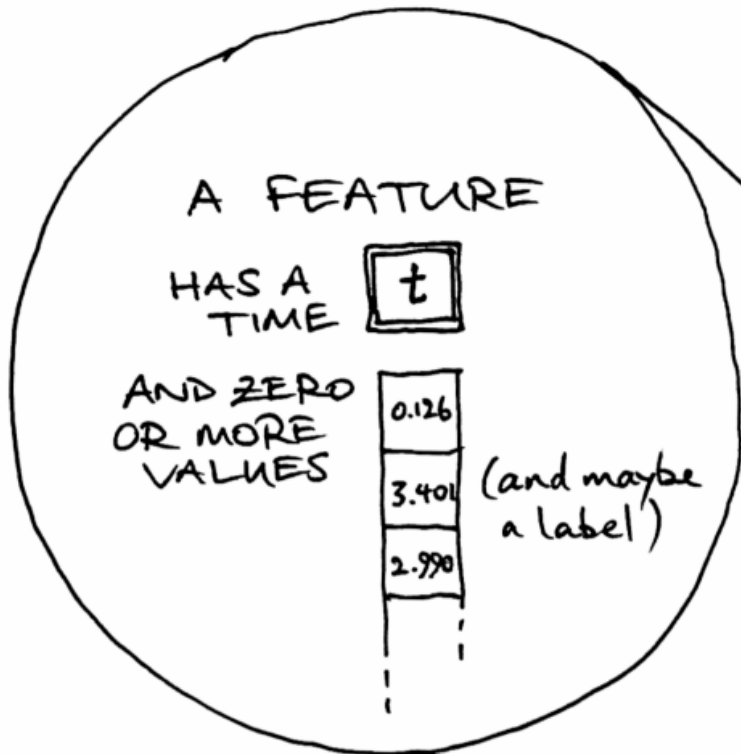
# Frequency-domain input



# What does a plugin return?

- Plugin may have many outputs, and always calculates all of them: host doesn't choose up front
- Each call to `process` or `getRemainingFeatures` may return zero or more “features” per output
- A feature has
  - Time (implicit or explicit)
  - Zero or more values
  - An optional label
- Empty features are perfectly valid





# What does a feature represent?

- Something that happened at a particular time
  - Note onset
  - Column of data for a chromatogram plot
  - Amplitude estimated from a particular region of input
- Time may be
  - *Explicit*: timestamp in the feature object
  - *Implicit*: deduced by the host based on the time in samples of the data passed in to process
  - this depends on the “sample type” for the output

# Values of a feature

- A feature may have values associated with it
  - Note onset (from simple onset detector) has no values
  - Column of chromagram data has lots of values
  - Amplitude has one value
- Host's understanding of the “meaning” of a feature depends on which output it is returned on
- Output descriptor may supply units, bin labels (for multi-value features), minimum/maximum extents
- In future: known feature types via RDF

# Some Limitations

- All values in a single feature must have same unit
  - Many real examples of features as points in multidimensional space are not comfortably handled
  - No proper way to express “duration” of a feature, a very common requirement
- No inputs other than audio – no plugin chaining
- Partial input blocks not supported
  - host has to zero-fill last block, can't tell plugin it is incomplete

# Pros and Cons compared with Matlab

- Pros
  - Can be used in many different host applications
  - Doesn't require big commercial supporting framework
  - May run faster or handle larger data sets
- Cons
  - Useless without a host
  - Needs to be recompiled for every target platform
  - Familiarity with C or C++ required
  - Things Matlab does by magic have to be written by hand
  - Algorithm must support block-by-block processing

# More

- Website:
  - <http://www.vamp-plugins.org/>
- Forum (complaints and announcements):
  - <http://www.vamp-plugins.org/forum/>
- Programmers Guide coming up “any day now”:
  - <http://www.vamp-plugins.org/develop.html>
  - just as boring as this presentation, but much longer
- Vamp SDK v1.2 out this week as well, perhaps