

FSMs *can* be Useful



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CTO, Vocalocity



# Hosted PBX Taxonomy



## ▶ Named Box

- Pure hosting
- Clustering/Virtual or Big Honking Box
- Load/Scaling issues same as 'one box' application

## ▶ High Level Application Server

- Calls generate *high level* events
- Events interact with application server
- Predefined spaces/features
- Load/Scaling issues same as 'one box' application



# Hosted PBX Taxonomy



- ▶ Granular Application Server
  - Calls generate *granular* events
  - Events interact with application server
  - Easy to create simple applications
    - Point features: FML, notifications, transcriptions
    - Call Switch: Routing, voicemail
- ▶ Difficult to build complex applications
  - Updates and deployments
  - Testing and Debugging
  - Concurrency
  - Scaling and Partitioning
  - Persistence



# Cloud Computing

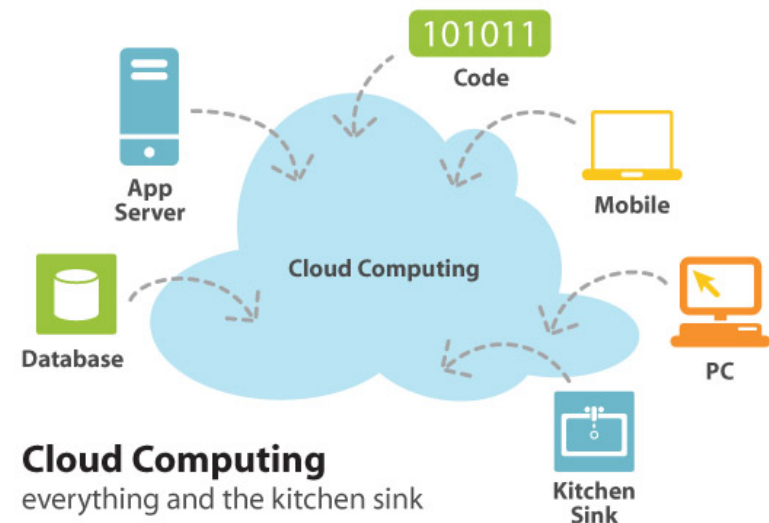


## ► Wikipedia

*“a style of computing in which typically real-time scalable resources are provided as a service over the Internet to end-users who need not have knowledge of, expertise in, or control over the technology infrastructure”*

## ► Vocalocity

- Horizontal Scaling and/or Clustering
- Abstraction of application layer
- SOA and/or fine-grained API
- Redundancy irrelevance



# Cloud Computing



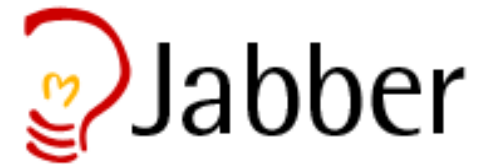
- ▶ Telephony makes it harder
  - Simple and distributed actions? **Done**
  - High Level Applications? **Done**
  - Both at the same time? **Well, Maybe Not...**
- ▶ Vocalocity
  - Distributed application infrastructure (erlang)
  - Distributed persistence infrastructure
  - Distributed telephony infrastructure
    - Simple, atomic events!!



# Why erlang?



- ▶ Testing
- ▶ Code deployment
- ▶ Concurrency
- ▶ Complexity
- ▶ Predictable Performance
- ▶ Fault tolerance
- ▶ Error Containment
- ▶ Testing
- ▶ Code Deployment



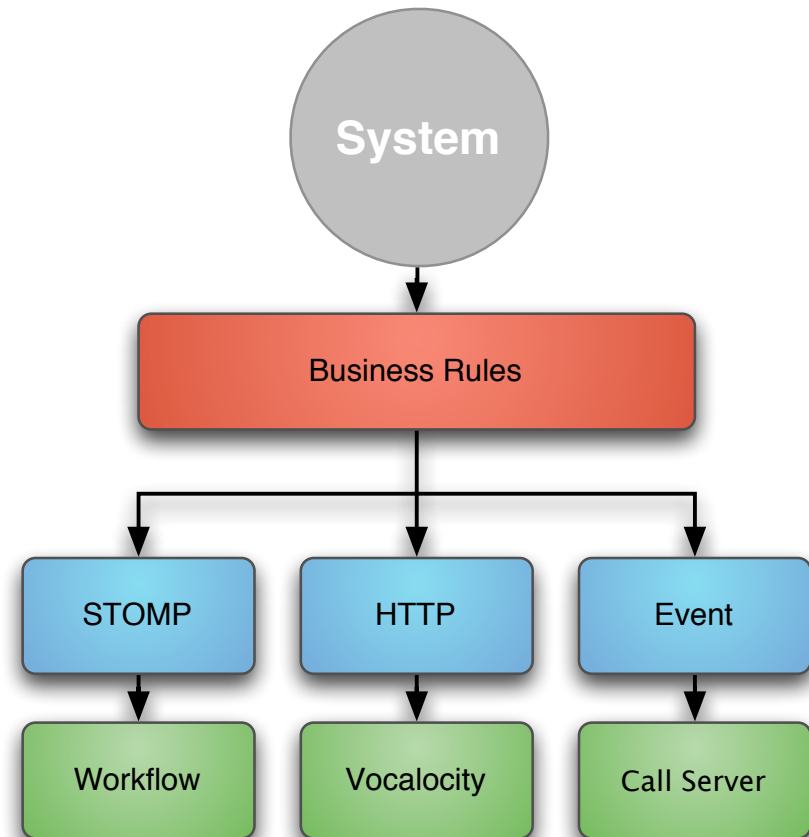
**MOTOROLA**



# Clean APIs



- ▶ Only interface into System
- ▶ Handlers for different modalities
  - HTTP for Public
  - STOMP for Private



# Clean APIs



## ▶ Administrative

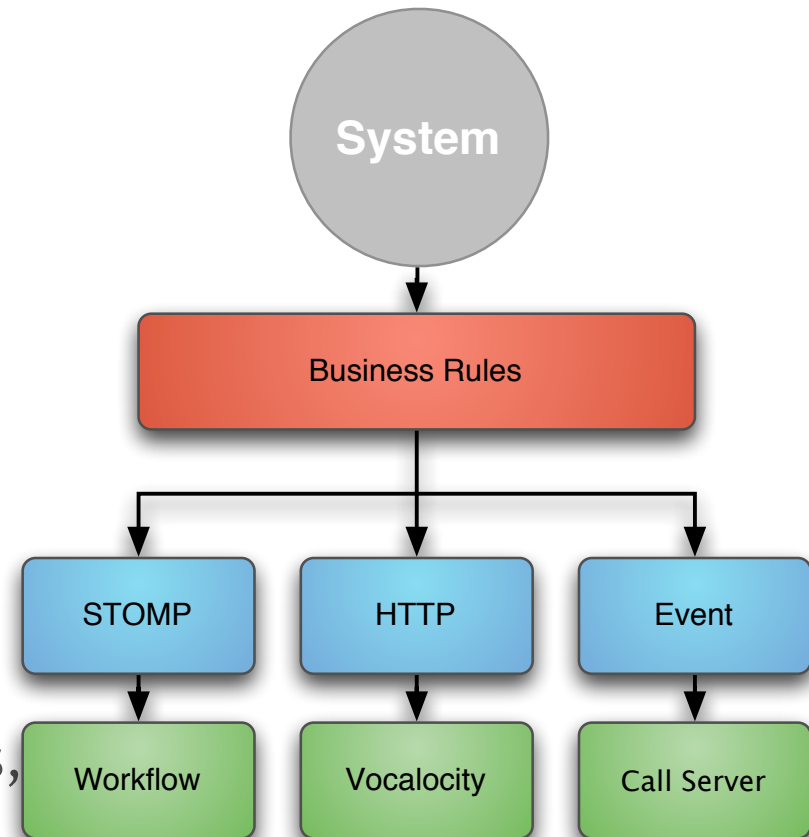
- CRUD - Users, Depts, ...
- Regulatory - E911, TRS, ...
- OSS

## ▶ Informative

- Notifications
- High Level Events
- Messages - History, Reporting

## ▶ Interactive

- Communications - Calls, Contacts, ...
- Profile - Blacklist, FML, Media, ...
- Messages - History, Reporting, ...

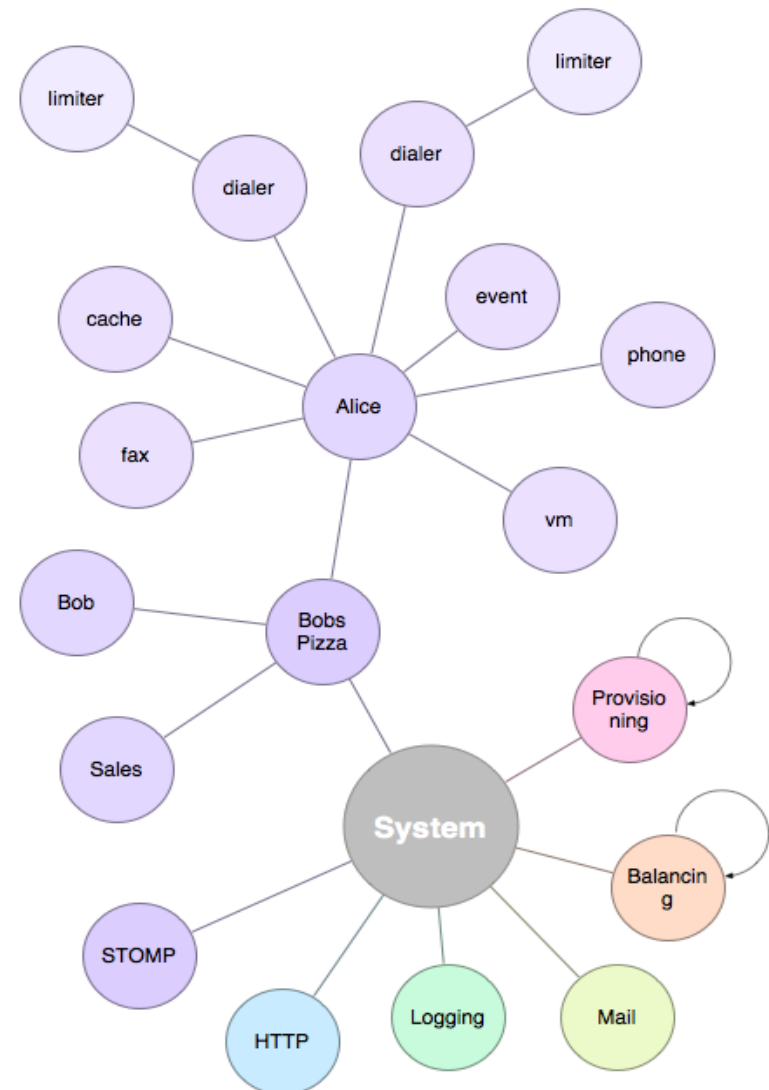




# Processes



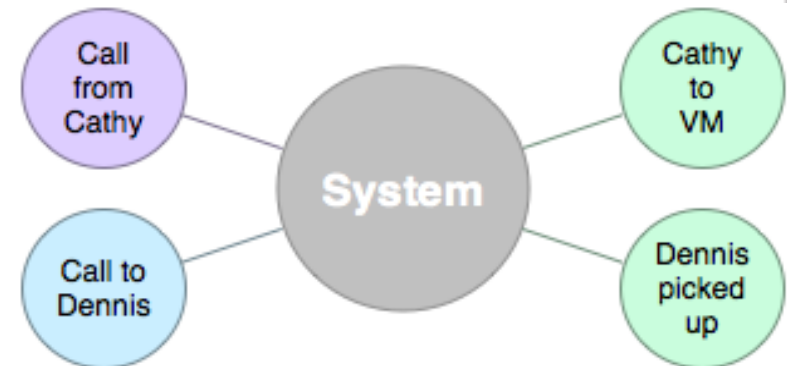
- ▶ All request goes to *any* available application node as a *message*
- ▶ Nodes have *processes*
  - *Users*
  - *Clients*
  - *Calls*
  - *Faxes*
  - *Phones*
  - *Load Balancers*
- ▶ Processes do things



# Event Handlers



- ▶ They get information to endpoints
  - GUI
  - API callbacks



**User Dashboard**

Active Calls	
Call	Status
To 202-292-4855	On Call

Control icons: [Pause] [Play] [Refresh] [Mute] [End Call]

**Find Me List**

- ✓ desk phone
- ✓ Mobile
- ✓ Bob
- ✓ Charlotte
- ✗ Mobile 2

Options:

- Add New Entry
- Edit 'desk phone'
- Remove 'desk phone'
- Set 'Follow Me'
- Do Not Disturb
- Manage Smart Find Me List

Contacts:

David Davidson	
Slade Jenkins	
Bob Johnson	
Mike Matthews	
Gregory Bledsoe	x363
Sam Bradley	x245
Brandon Brennan	x414
Elinor Canicosa	x114
Albert Carter	x244
David Castelhana	x612
Stefan Cleveland	x231
On the phone with:	x101
VMRELESS CALLER (301-875-1930)	x262

Conferences: Conference Bridge, Conference1

Drag & Drop to reorder. Click icon to enable/disable.



# Event Handlers



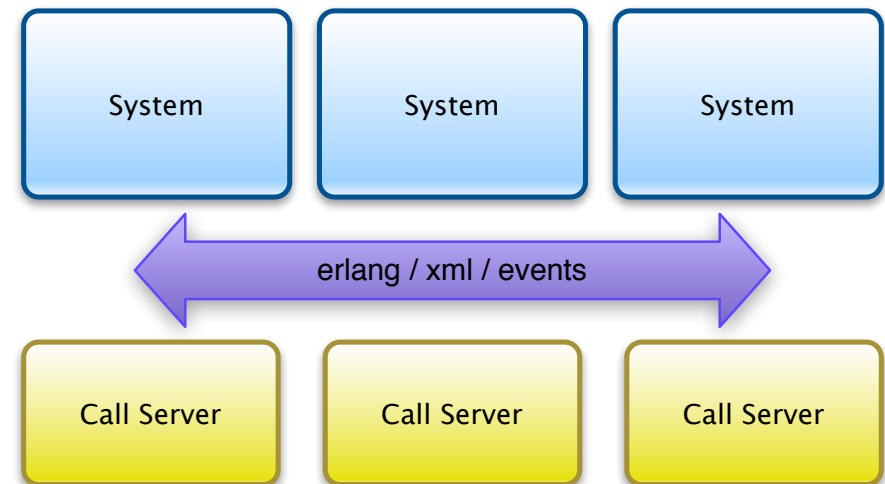
- ▶ The perform asynchronous application activities
  - Logging
  - notifications
- ▶ They bridge between the FSMs and the calls
  - Check blacklist
  - Play error message
  - Hangup
  - Go offhook



# Calling



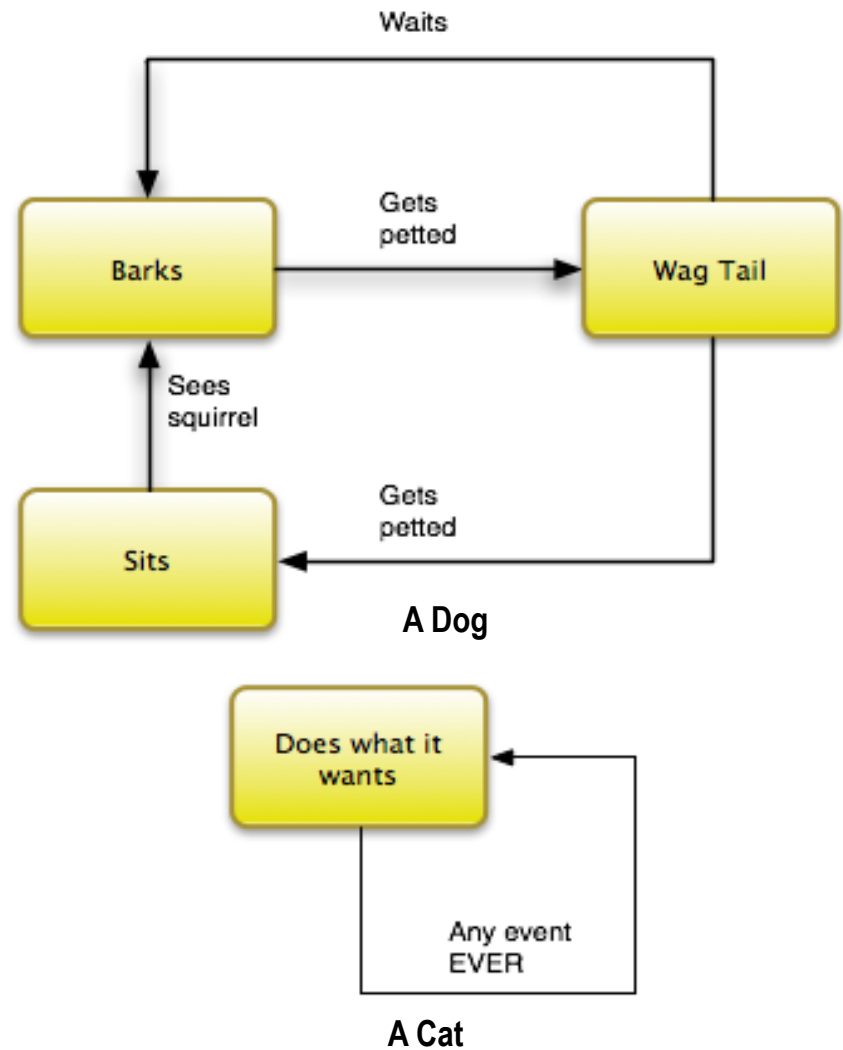
- ▶ Calls are tracked as *Processes*
- ▶ Event interface for requests and responses (XML)
- ▶ *fine-grained* events that can
  - make/break calls
  - record audio and dtmf
  - play audio and dtmf
  - file operations
- ▶ *Call Process* tracks
  - Channel parameters
  - FSM name and state



# Finite State Machines



- ▶ System has a limited set of states
- ▶ States transition based on conditions
- ▶ Transitions are atomic
- ▶ Events and actions at entry and exit



\* Diagrams from <http://learnyousomeerlang.com/finite-state-machines>

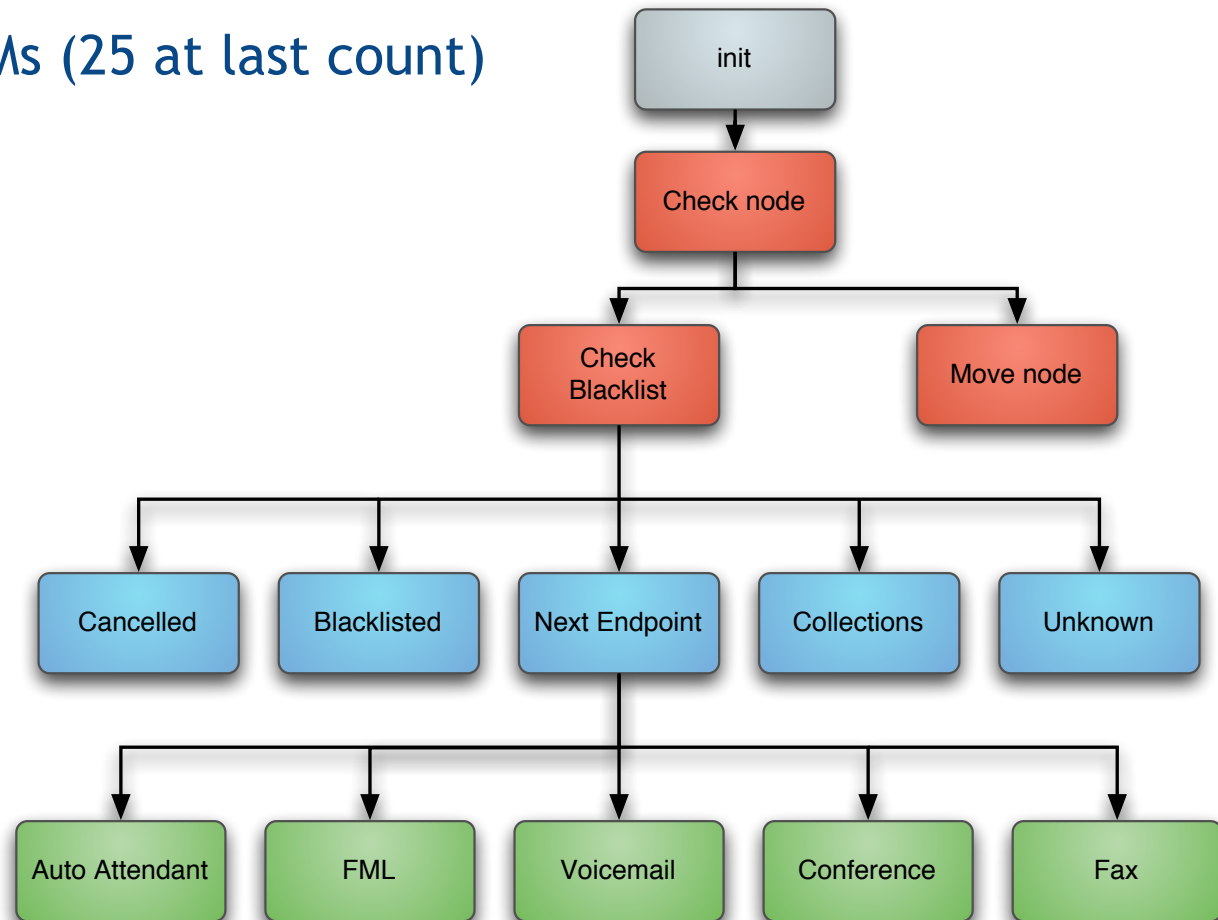


# Finite State Machines



► Many many *many* FSMs (25 at last count)

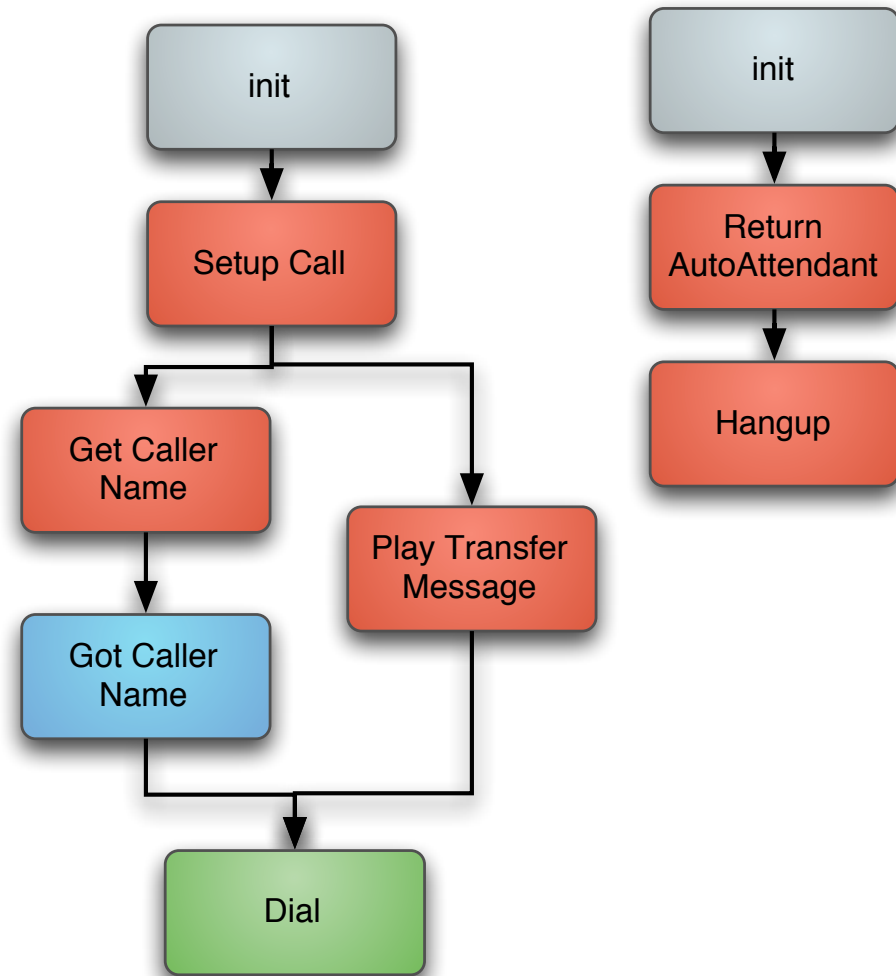
- Auto Attendant
- FML
- Voicemail
- Conference
- Fax
- C2C
- Video
- Directory
- Search
- Announcements
- Paging



# Finite State Machines



- ▶ Templates are your friend
- ▶ So are BIG sheets of paper.
- ▶ More is merrier
- ▶ But keep them simple, OK?
- ▶ Mixing States is BAD
- ▶ As is my haiku talent.



FSMs *can* be Useful - See?



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