µService and Scribble
aka
Scribble @ ThoughtWorks

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(With thanks to Ray Hu)

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Structured Engineering @ TW

We propose that creating a practice within TW to concentrate on what we will call "Structural Engineering" will provide a focus to concentrate and leverage our experience in this area.

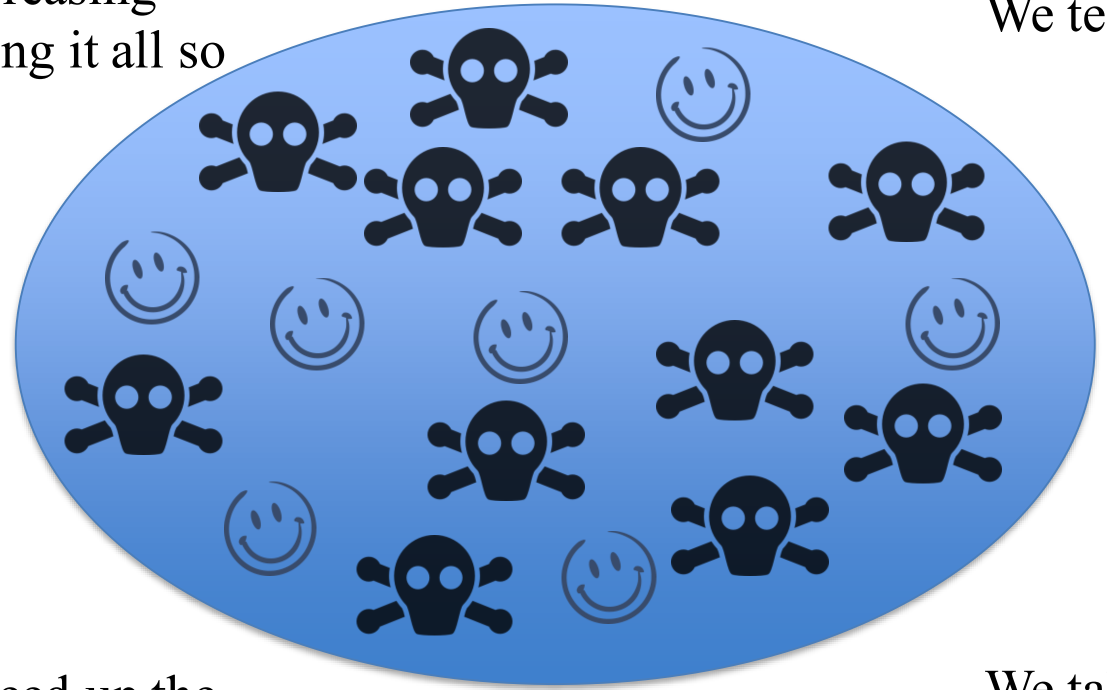
There are five constituent elements:

- Education (Theory, Practices and Research)
- Tools (Architectural Simulation Laboratories)
- Consultancy (offerings for both clients and internal teams)
- Collaboration (with external organisations e.g. Universities)
- TW Logistics (people and cash)

The world of programming

There is an increasing chance of getting it all so terribly wrong

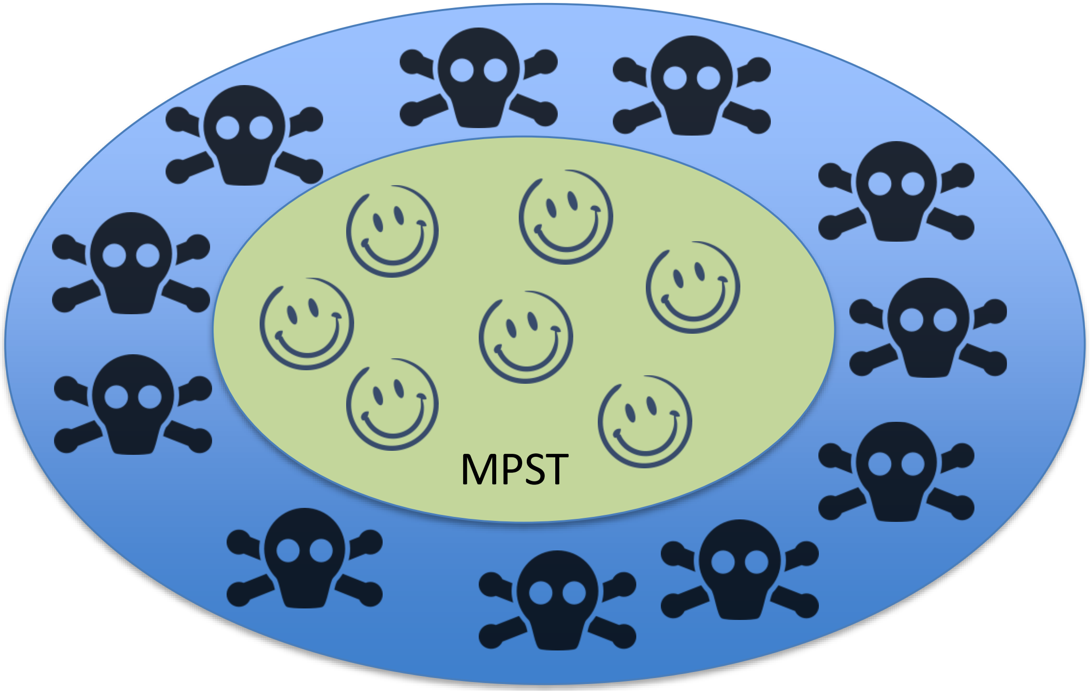
We test a lot



We try to speed up the lifecycle of development so we can make mistakes earlier

We talk a lot (but never enough)

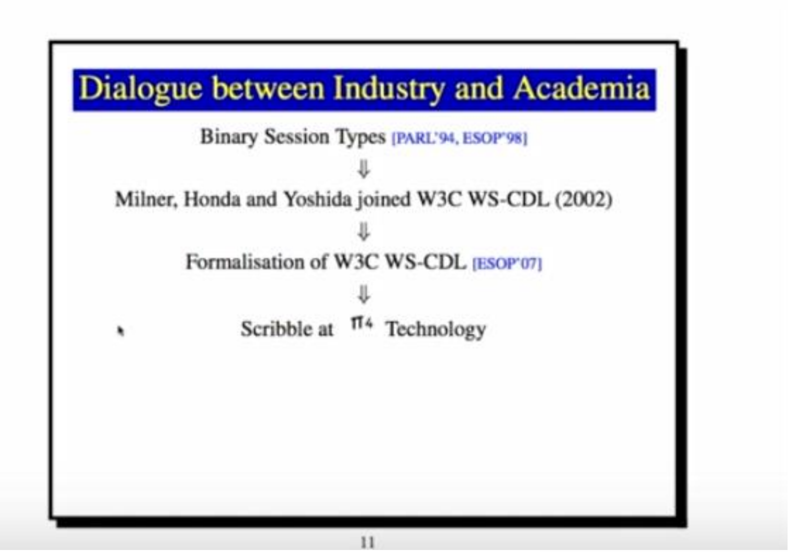
The world of programming



Multiparty session types offer us a way of understanding our digital world better. It offers a way for us to better identify what is good and what is bad as complexity increases.

It does this by uncovering structure, the structure of communication based on observable behavior in a distributed plain. Hence structured engineering @ TW!

Multi-party session types & Scribble



Dialogue between Industry and Academia

Binary Session Types [PARL'94, ESOP'98]

⇓

Milner, Honda and Yoshida joined W3C WS-CDL (2002)

⇓

Formalisation of W3C WS-CDL [ESOP'07]

⇓

Scribble at π4 Technology

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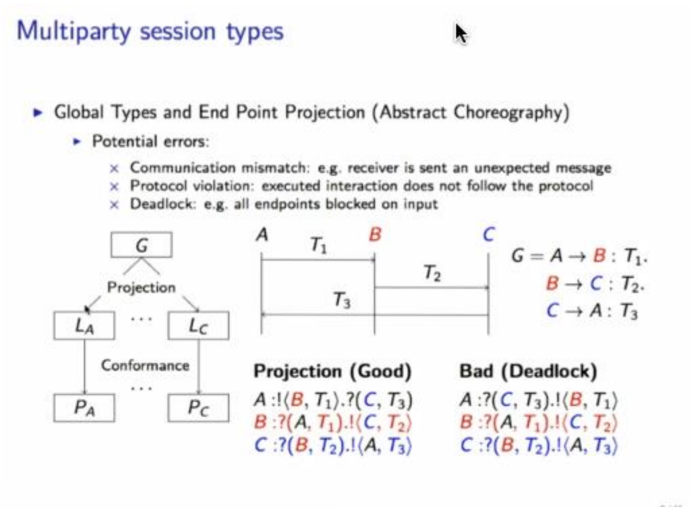


Multiparty session types

- Global Types and End Point Projection (Abstract Choreography)
  - Potential errors:
    - × Communication mismatch: e.g. receiver is sent an unexpected message
    - × Protocol violation: executed interaction does not follow the protocol
    - × Deadlock: e.g. all endpoints blocked on input

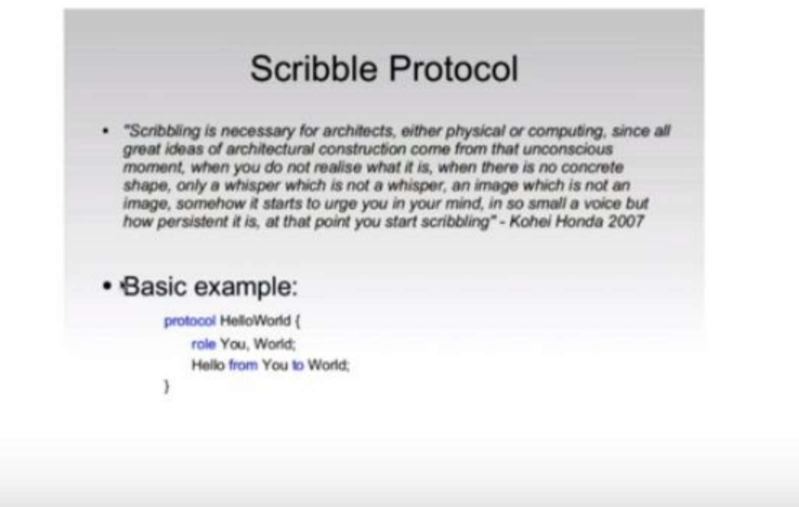
$$\begin{aligned} G = A \to B &: T_1.\\ B \to C &: T_2.\\ C \to A &: T_3 \end{aligned}$$

Projection (Good)

$A :!\langle B, T_1\rangle.?(C, T_3)$
$B :?(A, T_1).!\langle C, T_2\rangle$
$C :?(B, T_2).!\langle A, T_3\rangle$

Bad (Deadlock)

$A :?(C, T_3).!\langle B, T_1\rangle$
$B :?(A, T_1).!\langle C, T_2\rangle$
$C :?(B, T_2).!\langle A, T_3\rangle$



Scribble Protocol

- *"Scribbling is necessary for architects, either physical or computing, since all great ideas of architectural construction come from that unconscious moment, when you do not realise what it is, when there is no concrete shape, only a whisper which is not a whisper, an image which is not an image, somehow it starts to urge you in your mind, in so small a voice but how persistent it is, at that point you start scribbling" - Kohei Honda 2007*

- Basic example:

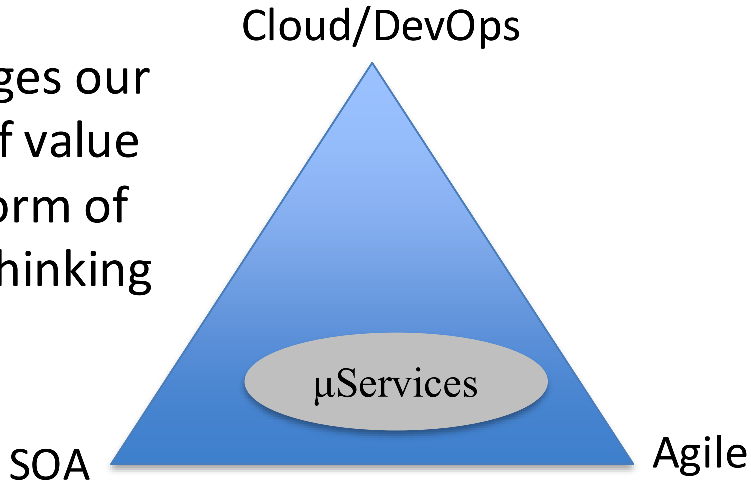
```
protocol HelloWorld {
    role You, World;
    Hello from You to World;
}
```

Nobuko Yoshida, 2016 –
https://www.youtube.com/watch?v=HEg088cW528

µService's

A Micro service is normally part of a suite of independently deployable services that support a specific business goal using simple, well-defined interfaces to communicate with each other. Typically they are small and have language-agnostic APIs.

"throw-it-away" challenges our conventional IT notion of value and encourages a new form of re-use that is based on thinking and innovation.



µService's and Serverless Architectures

A µService's is the leven bread of serverless computing.

Serverless computing is the new Cloud/DevOps that incorporates fast instantiation into a cloud of executable containers each able to execute the bundle of behaviors that a set of µService's exhibit.

June 17, 2016: "The Evolution of Microservices," Adrian Cockroft - https://learning.acm.org/webinar/

5/63 "The Evolution of Microservices," Adrian Cockroft

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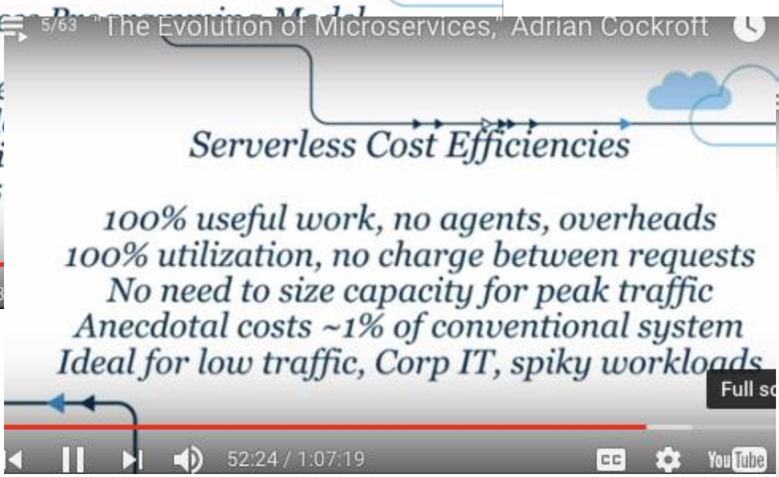
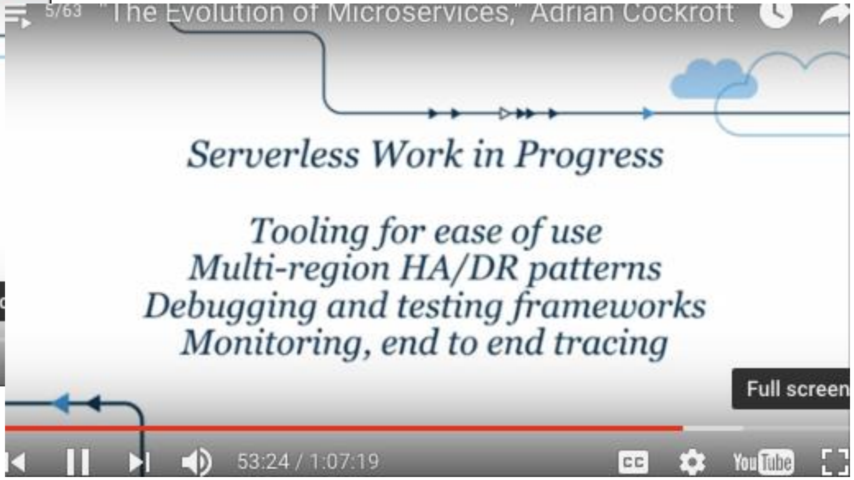

5/63 "The Evolution of Microservices," Adrian Cockroft

Serverless Cost Efficiencies

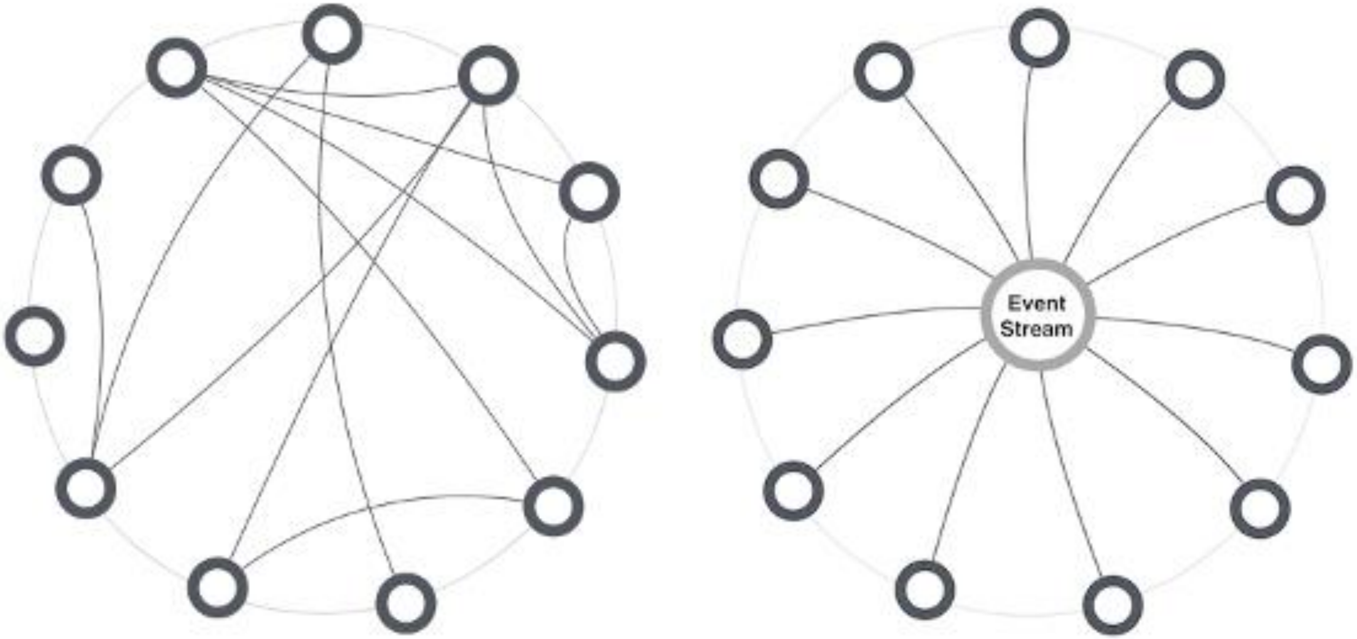
100% useful work, no agents, overheads
100% utilization, no charge between requests
No need to size capacity for peak traffic
Anecdotal costs ~1% of conventional system
Ideal for low traffic, Corp IT, spiky workloads


5/63 "The Evolution of Microservices," Adrian Cockroft

Serverless Work in Progress

Tooling for ease of use
Multi-region HA/DR patterns
Debugging and testing frameworks
Monitoring, end to end tracing

μService’s and Scribble



Orchestration vs. Choreography, Source: *www.thoughtworks.com*

On the left site an orchestration with point-to-point connections is shown. **On the right** site a choreography pattern is shown where each service waits for events to act on.

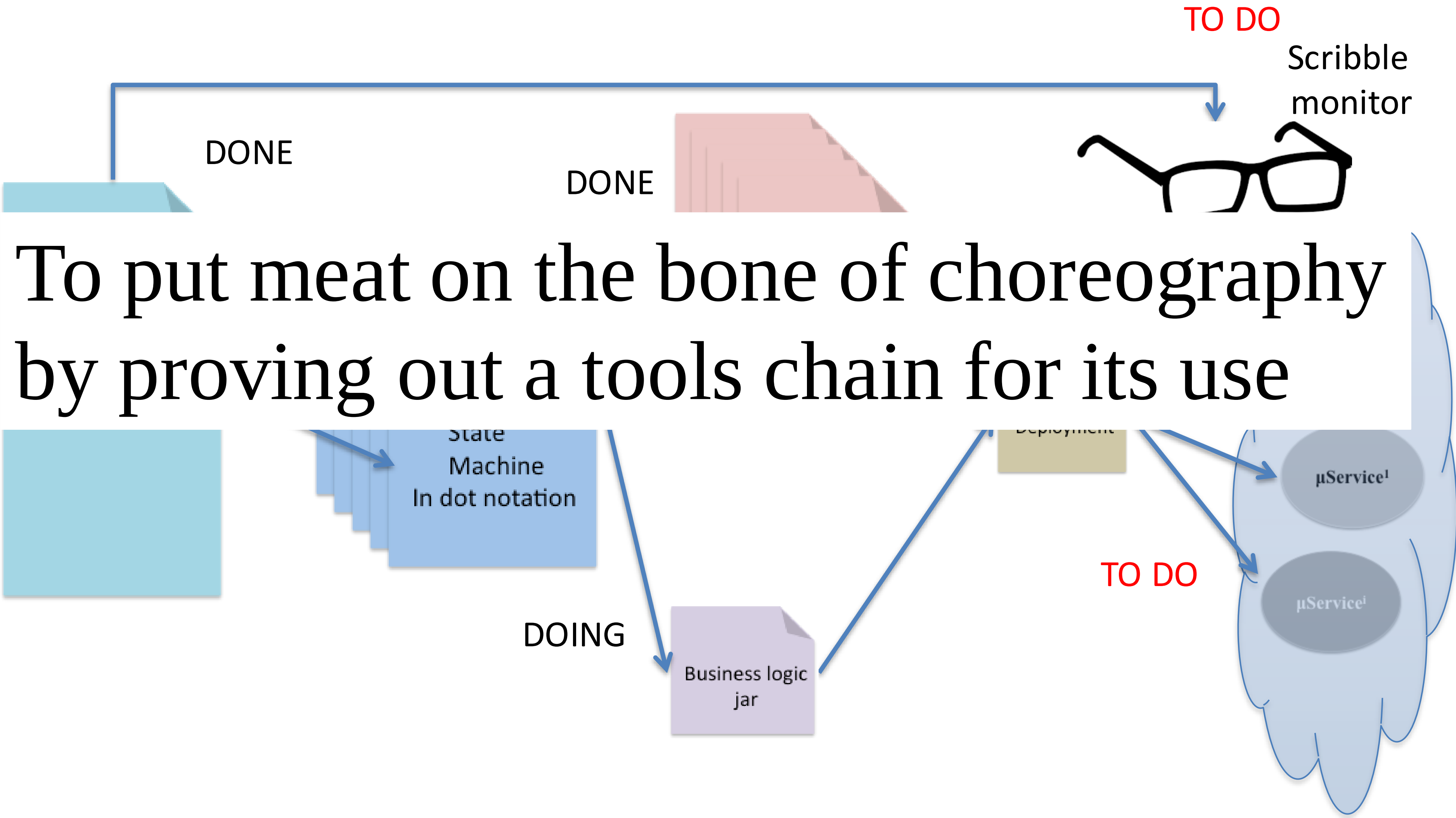
A choreography promoted loose coupling

The problem I have found is that very few people understand what a choreography really is, let alone how it can be described and used. Rather a choreography is a loose description or a way of doing things. A style if you will.

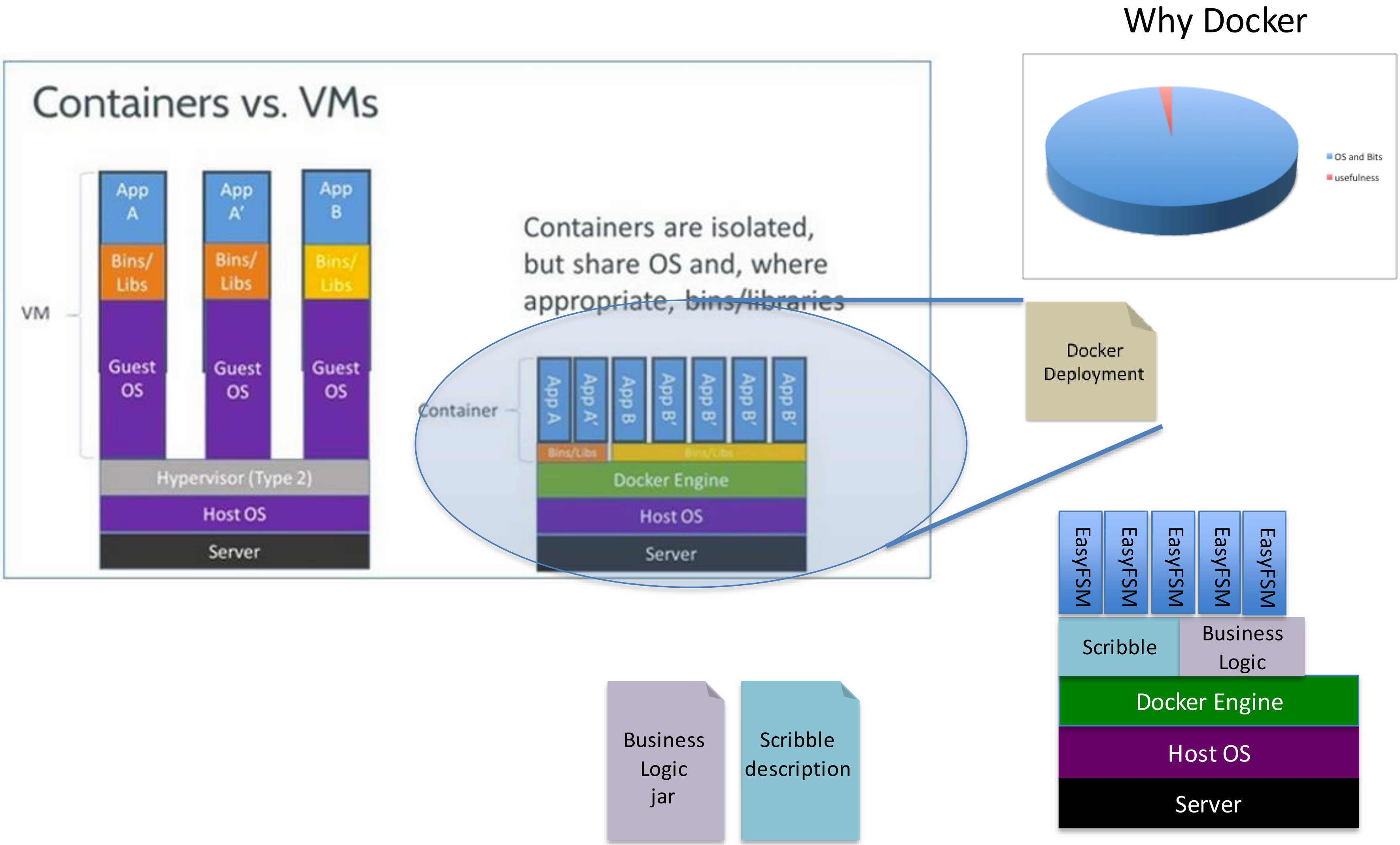
Whereas we know differently!!

What we are trying to do

To put meat on the bone of choreography by proving out a tools chain for its use

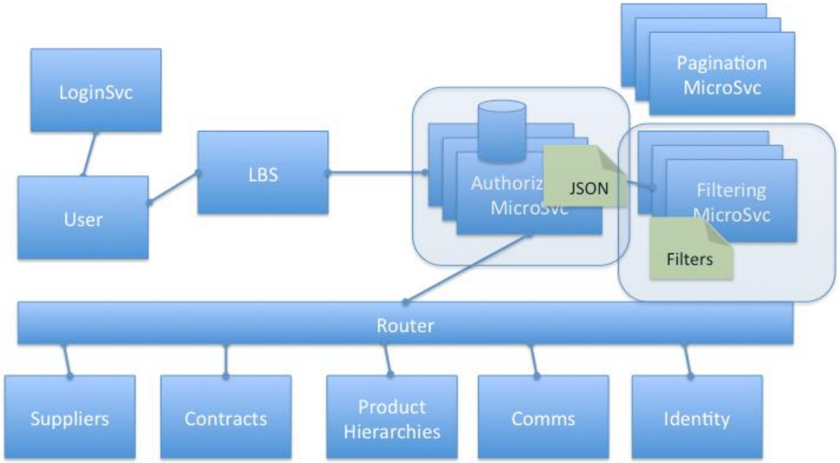


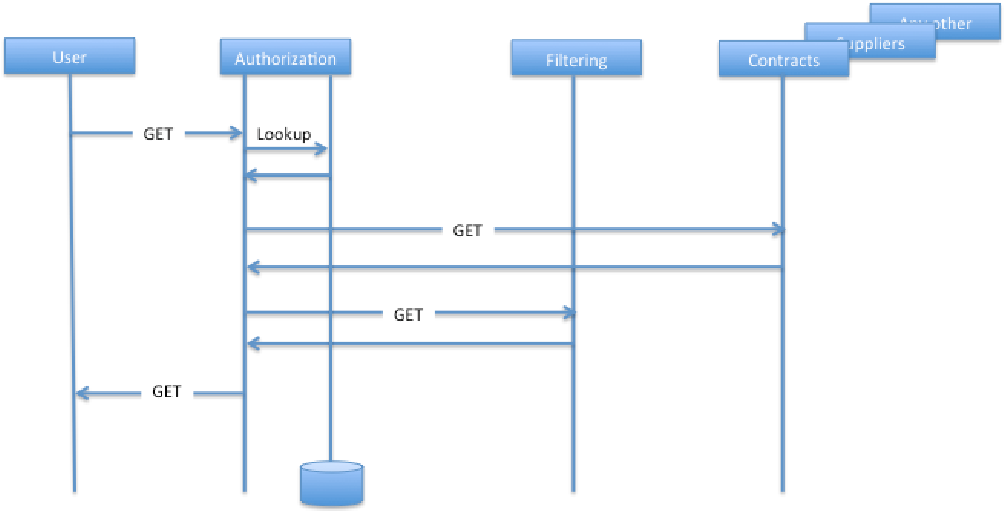
Behavioral Docking



μService's as FSM's

A real world example





µService's as FSM's

The scribble

```
explicit global protocol PartnershipSupplier ( role loginsvc,  requestor,  authorisersvc,
                                                           filtersvc,  suppliersvc,  contractsvc)
{
      connect requestor to loginsvc;
      login(username, password) from requestor to loginsvc;
      choice at loginsvc {
            loginFailure() from loginsvc to requestor;
            disconnect requestor and loginsvc;
      } or {
            loginSuccess(uuid) from loginsvc to requestor;
            connect requestor to authorisersvc;
            connect authorisersvc to filtersvc;
            do Main(requestor, authorisersvc, filtersvc, suppliersvc, contractsvc);
      }
}
```

µService's as FSM's

The scribble

```
aux global protocol Main ( role requestor,  authorisersvc,  filtersvc,  suppliersvc,  contractsvc )
{
    choice at requestor {                                   // GET SUPPLIER INFO
        getSuppliers(uuid) from requestor to authorisersvc;
        do SuppInfo(requestor, authorisersvc, filtersvc, suppliersvc);
    } or {                                                  // GET CONTRACT INFO
        getContracts(uuid) from requestor to authorisersvc;
        do ContractInfo(requestor, authorisersvc, filtersvc, contractsvc);
    }
    do Main(requestor, authorisersvc, filtersvc, suppliersvc, contractsvc);
}
```

µService’s as FSM’s

The scribble

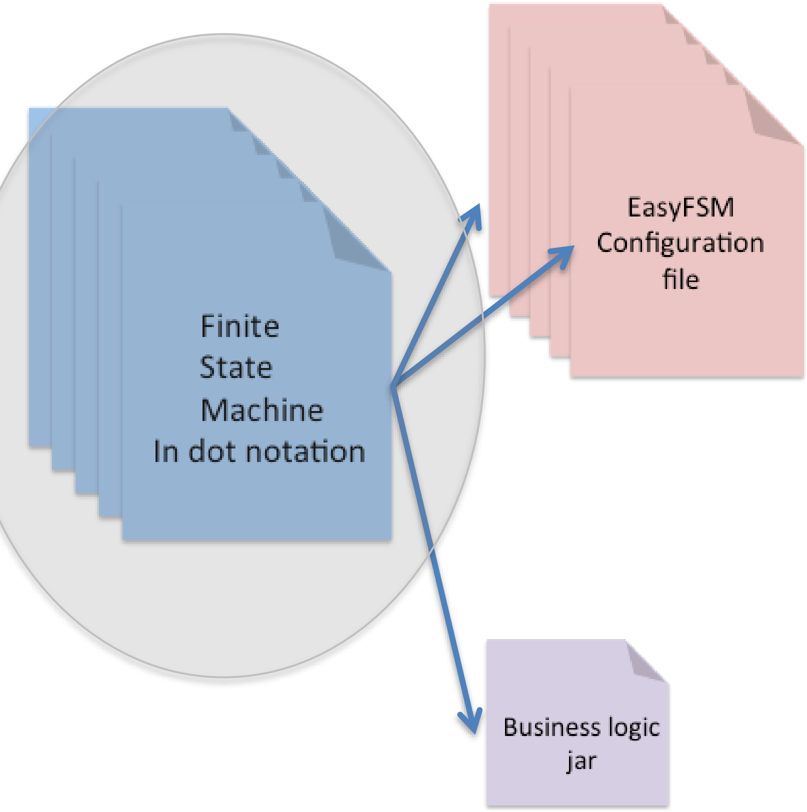
```
aux global protocol SuppInfo ( role requestor,  authorisersvc,  filtersvc,  suppliersvc )
{
    choice at authorisersvc {                   // DENIED
        deny() from authorisersvc to requestor;
        exit() from authorisersvc to filtersvc;
    } or {                                      // PREPARE FILTERED SUPPLIER INFO FOR REQUESTOR
        connect authorisersvc to suppliersvc;
        getsuppliers(uuid) from authorisersvc to suppliersvc;
        getsuppliersRtn(supplierdetails) from suppliersvc to authorisersvc;
        do FilterInfo <filterSupplier(usercontext, filters, supplierdetails)>
                                          (authorisersvc, filtersvc);
        disconnect authorisersvc and suppliersvc;
        getSuppliersRtn() from authorisersvc to requestor;
    }
}
```

µService's as FSM's

The scribble

```
aux global protocol ContractInfo ( role requestor,  authorisersvc,  filtersvc,  contractsvc ) {
    choice at authorisersvc {                     // DENIED
        deny() from authorisersvc to requestor;
        exit() from authorisersvc to filtersvc;
    } or {                                        // PREPARE FILTERED SUPPLIER INFO FOR REQUESTOR
        connect authorisersvc to contractsvc;
        getContracts(uuid) from authorisersvc to contractsvc;
        getContractsRtn(contractdetails) from contractsvc to authorisersvc;
        do FilterInfo <filterContract(usercontext, filters, contractdetails)>
                                              (authorisersvc, filtersvc);
        disconnect authorisersvc and contractsvc;
        contracts() from authorisersvc to requestor;
    }
}
aux global protocol FilterInfo < sig Query > (  role authorisersvc,  filtersvc ) {
    Query from authorisersvc to filtersvc;
    filtered() from filtersvc to authorisersvc;
}
```

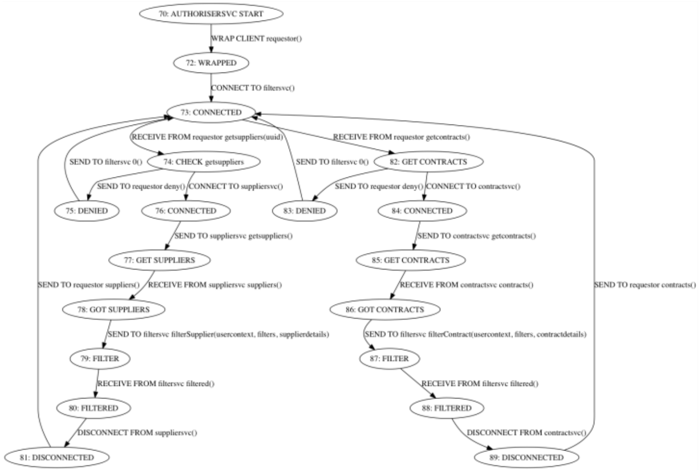
µService’s as FSM’s



Finite State Machine In dot notation

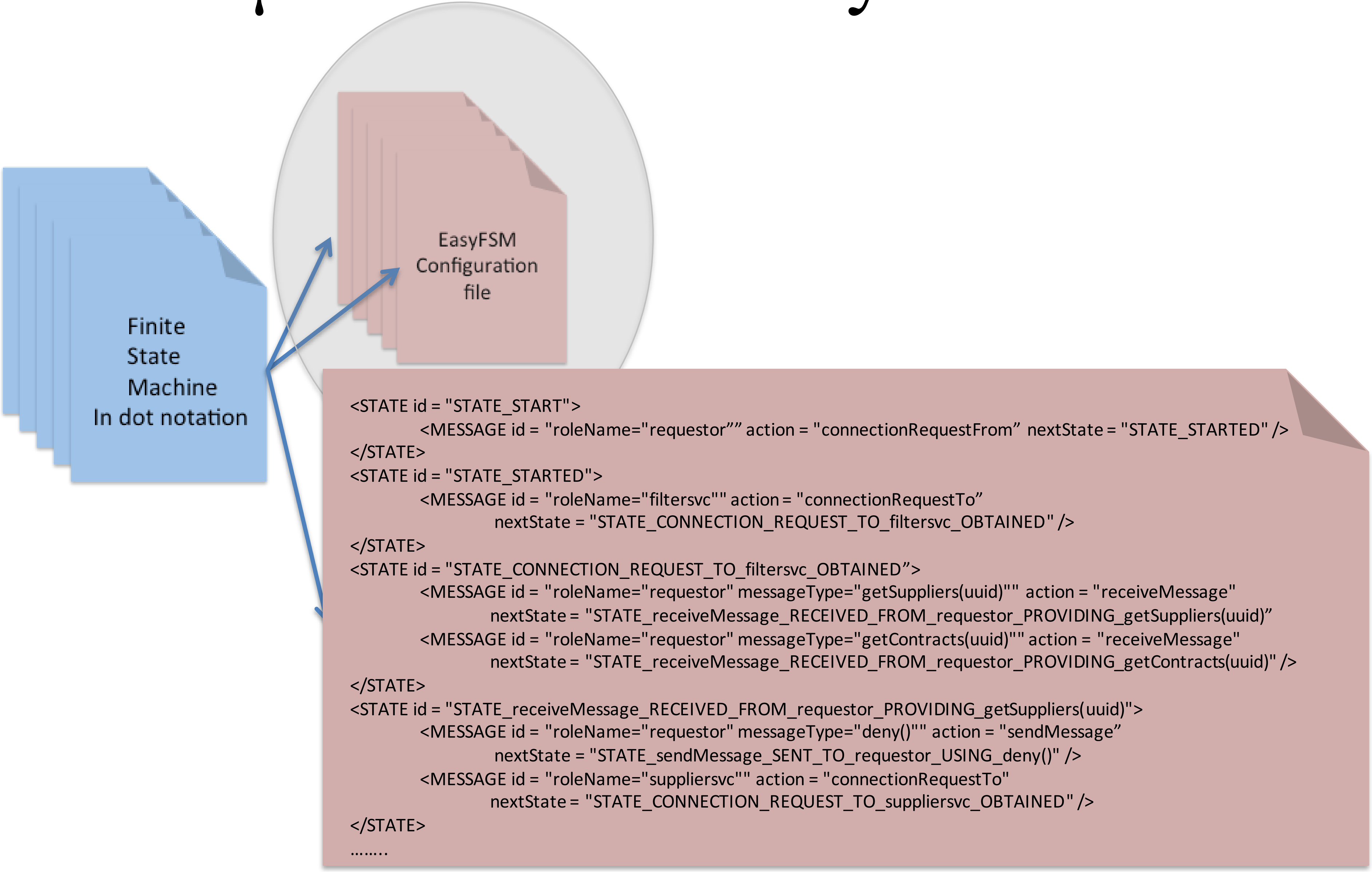
EasyFSM Configuration file

Business logic jar


70: AUTHORISERSVC START
WRAP CLIENT requestor()
72: WRAPPED
CONNECT TO filtersvc()
73: CONNECTED
RECEIVE FROM requestor getsuppliers(uuid)
RECEIVE FROM requestor getcontracts()
SEND TO filtersvc 0()
74: CHECK getsuppliers
SEND TO filtersvc 0()
82: GET CONTRACTS
SEND TO requestor deny()
CONNECT TO suppliersvc()
SEND TO requestor deny()
CONNECT TO contractsvc()
75: DENIED
76: CONNECTED
83: DENIED
84: CONNECTED
SEND TO suppliersvc getsuppliers()
SEND TO contractsvc getcontracts()
77: GET SUPPLIERS
85: GET CONTRACTS
SEND TO requestor suppliers()
RECEIVE FROM suppliersvc suppliers()
RECEIVE FROM contractsvc contracts()
SEND TO requestor contracts()
78: GOT SUPPLIERS
86: GOT CONTRACTS
SEND TO filtersvc filterSupplier(usercontext, filters, supplierdetails)
SEND TO filtersvc filterContract(usercontext, filters, contractdetails)
79: FILTER
87: FILTER
RECEIVE FROM filtersvc filtered()
RECEIVE FROM filtersvc filtered()
80: FILTERED
88: FILTERED
DISCONNECT FROM suppliersvc()
DISCONNECT FROM contractsvc()
81: DISCONNECTED
89: DISCONNECTED

```
digraph G {
compound = true;
"70" [ label="70: COMPLETED" ];
"70" -> "72" [ label="requestor -> MakeNewServerSideConnection()"  ];
"72" [ label="72: " ];
"72" -> "73" [ label="filtersvc -> MakeNewClientSideConnection()"  ];
"73" [ label="73: COMPLETED" ];
"73" -> "74" [ label="requestor Receive getsuppliers(uuid)"  ];
"74" [ label="74: COMPLETED" ];
"74" -> "75" [ label="requestor Send deny()" ];
"75" [ label="75: " ];
"75" -> "73" [ label="filtersvc Send end()" ];
"74" -> "76" [ label="suppliersvc -> MakeNewClientSideConnection()"  ];
"76" [ label="76: " ];
"76" -> "77" [ label="suppliersvc Send getsuppliers()" ];
"77" [ label="77: " ];
"77" -> "78" [ label="suppliersvc Receive suppliers()"  ];
"78" [ label="78: COMPLETED" ];
"78" -> "79" [ label="filtersvc Send filterSupplier(usercontext, filters, supplierdetails)" ];
```

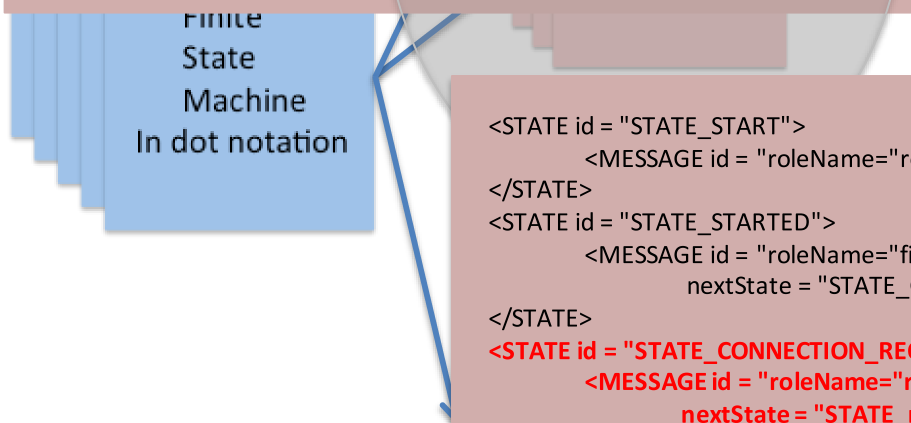
µService’s as EasyFSM’s



```
<STATE id = "STATE_START">
            <MESSAGE id = "roleName="requestor”” action = "connectionRequestFrom”  nextState = "STATE_STARTED" />
</STATE>
<STATE id = "STATE_STARTED">
            <MESSAGE id = "roleName="filtersvc"" action = "connectionRequestTo”
                         nextState = "STATE_CONNECTION_REQUEST_TO_filtersvc_OBTAINED" />
</STATE>
<STATE id = "STATE_CONNECTION_REQUEST_TO_filtersvc_OBTAINED”>
            <MESSAGE id = "roleName="requestor" messageType="getSuppliers(uuid)"" action = "receiveMessage"
                        nextState = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getSuppliers(uuid)”
            <MESSAGE id = "roleName="requestor" messageType="getContracts(uuid)"" action = "receiveMessage"
                        nextState = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getContracts(uuid)" />
</STATE>
<STATE id = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getSuppliers(uuid)">
            <MESSAGE id = "roleName="requestor" messageType="deny()"" action = "sendMessage”
                         nextState = "STATE_sendMessage_SENT_TO_requestor_USING_deny()" />
            <MESSAGE id = "roleName="suppliersvc"" action = "connectionRequestTo"
                        nextState = "STATE_CONNECTION_REQUEST_TO_suppliersvc_OBTAINED" />
</STATE>
……..
```

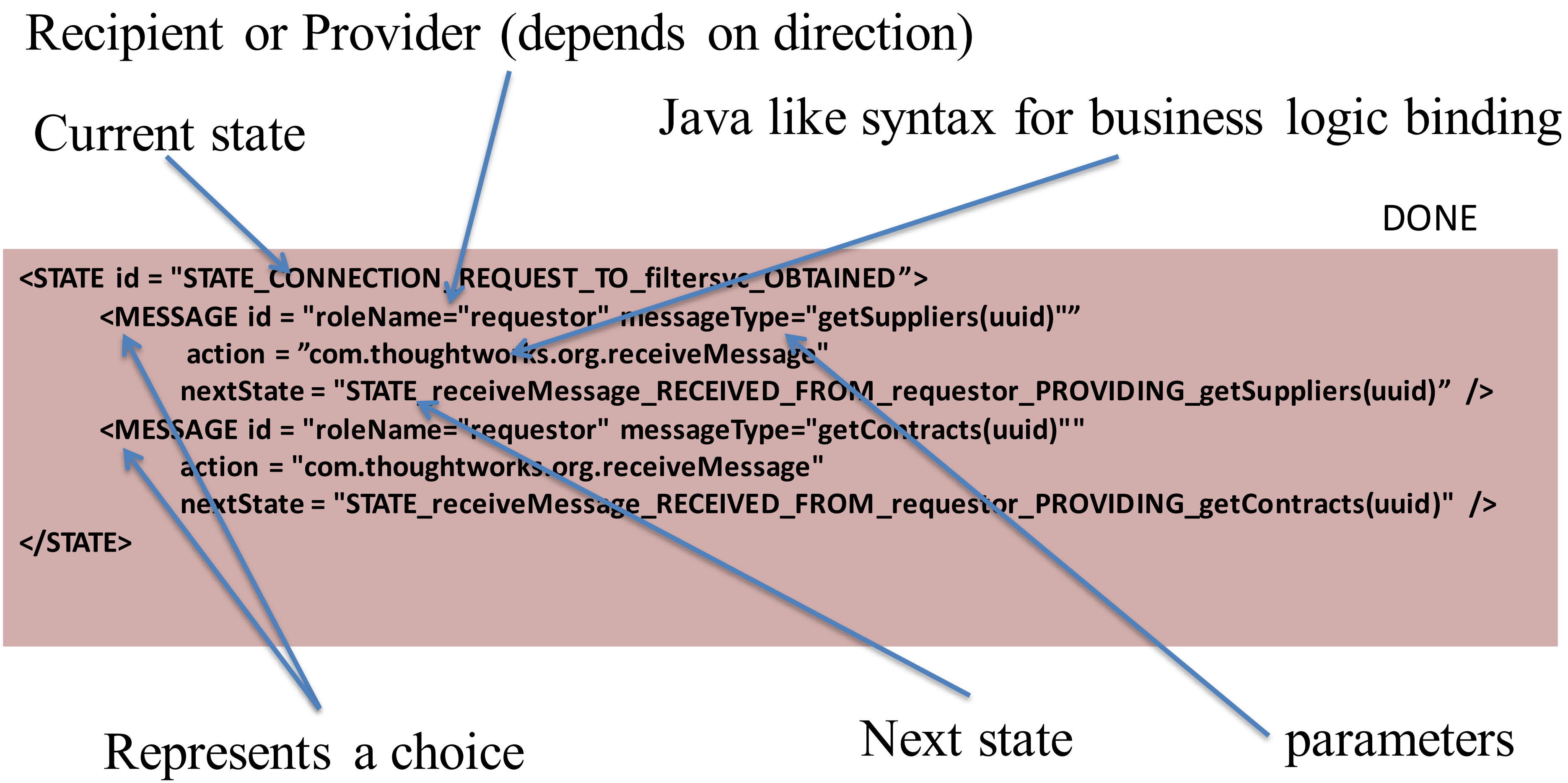
µService’s as EasyFSM’s

```
<STATE id = "STATE_CONNECTION_REQUEST_TO_filtersvc_OBTAINED”>
        <MESSAGE id = "roleName="requestor" messageType="getSuppliers(uuid)"”
                 action = ”com.thoughtworks.org.receiveMessage"
                nextState = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getSuppliers(uuid)” />
        <MESSAGE id = "roleName="requestor" messageType="getContracts(uuid)""
                action = "com.thoughtworks.org.receiveMessage"
                nextState = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getContracts(uuid)" />
</STATE>
```



```
<STATE id = "STATE_START">
        <MESSAGE id = "roleName="requestor”” action = "connectionRequestFrom”  nextState = "STATE_STARTED" />
</STATE>
<STATE id = "STATE_STARTED">
        <MESSAGE id = "roleName="filtersvc"" action = "connectionRequestTo”
                nextState = "STATE_CONNECTION_REQUEST_TO_filtersvc_OBTAINED" />
</STATE>
<STATE id = "STATE_CONNECTION_REQUEST_TO_filtersvc_OBTAINED”>
        <MESSAGE id = "roleName="requestor" messageType="getSuppliers(uuid)"" action = "receiveMessage"
                nextState = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getSuppliers(uuid)”  />
        <MESSAGE id = "roleName="requestor" messageType="getContracts(uuid)"" action = "receiveMessage"
                nextState = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getContracts(uuid)" />
</STATE>
<STATE id = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getSuppliers(uuid)">
        <MESSAGE id = "roleName="requestor" messageType="deny()"" action = "sendMessage”
                nextState = "STATE_sendMessage_SENT_TO_requestor_USING_deny()" />
        <MESSAGE id = "roleName="suppliersvc"" action = "connectionRequestTo"
                nextState = "STATE_CONNECTION_REQUEST_TO_suppliersvc_OBTAINED" />
</STATE>
……..
```

μService’s as EasyFSM’s



Recipient or Provider (depends on direction)

Current state

Java like syntax for business logic binding

DONE

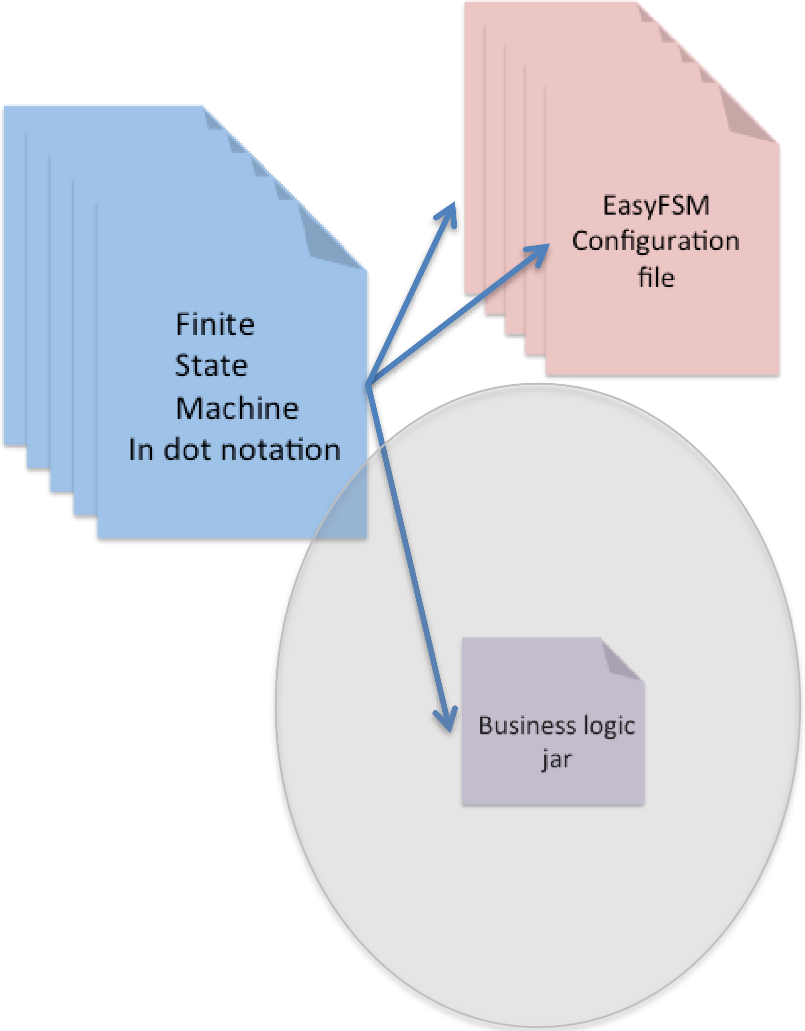
```
<STATE id = "STATE_CONNECTION_REQUEST_TO_filtersvc_OBTAINED”>
        <MESSAGE id = "roleName="requestor" messageType="getSuppliers(uuid)"”
                 action = ”com.thoughtworks.org.receiveMessage"
                nextState = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getSuppliers(uuid)”  />
        <MESSAGE id = "roleName="requestor"  messageType="getContracts(uuid)""
                action = "com.thoughtworks.org.receiveMessage"
                nextState = "STATE_receiveMessage_RECEIVED_FROM_requestor_PROVIDING_getContracts(uuid)"  />
</STATE>
```

Represents a choice

Next state

parameters

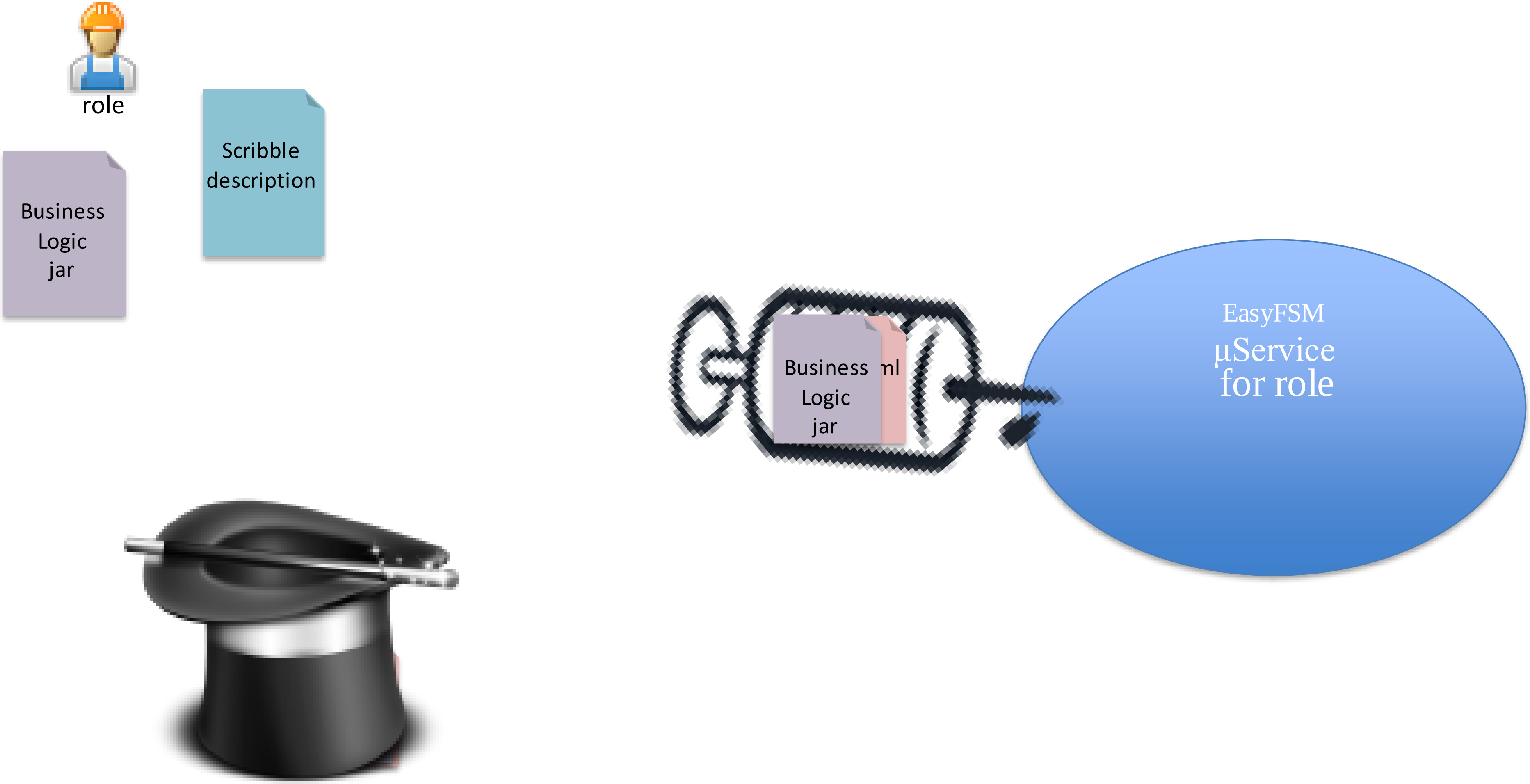
μService's and business logic



Some sort of java jar file incorporating all of the business function method calls and their parameter types as names.

To be implemented by the programmer is the business logic itself within the method calls and the parameter types as member variables to be stored as needed.

Scribble and µServices runtime



role

Scribble description

Business Logic jar

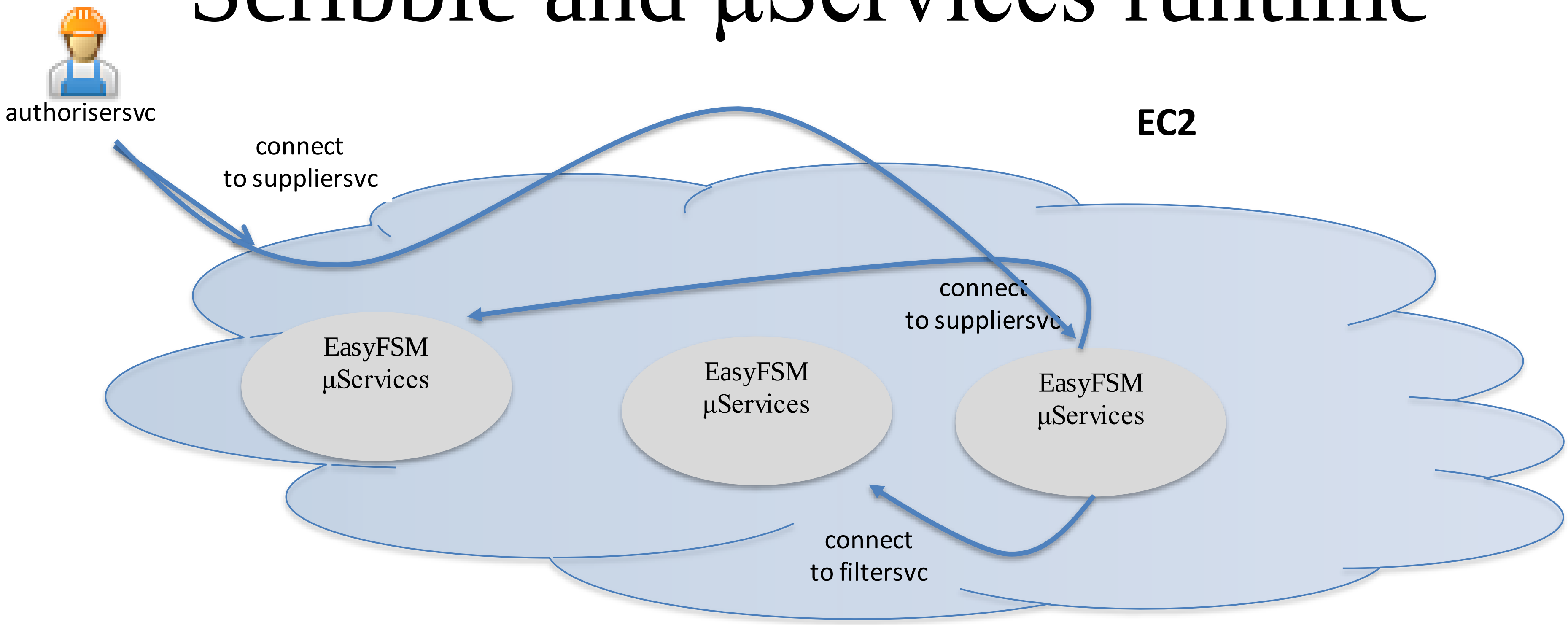
Business Logic jar

ml

EasyFSM µService for role

Lazy instantiation of scribble-defined µServices

Scribble and µServices runtime



authorisersvc

connect
to suppliersvc

EC2

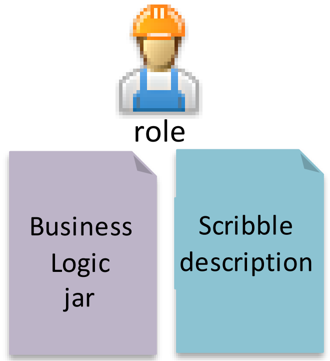
EasyFSM
µServices

EasyFSM
µServices

EasyFSM
µServices

connect
to suppliersvc

connect
to filtersvc



role

Business
Logic
jar

Scribble
description

requestor

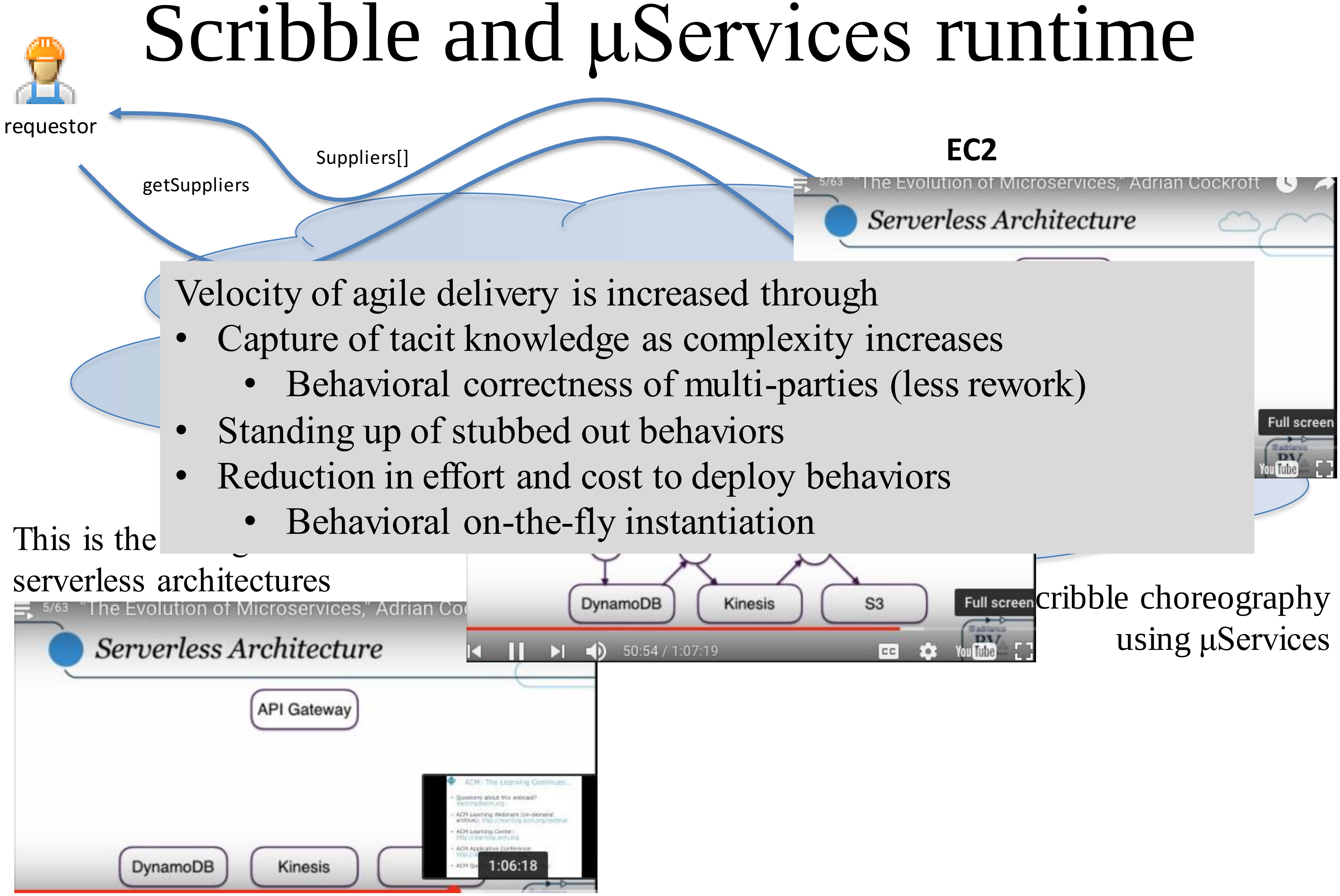
filtersvc

suppliersvc

contractsvc

Lazy instantiation of scribble-defined µServices

Scribble and µServices runtime



Velocity of agile delivery is increased through

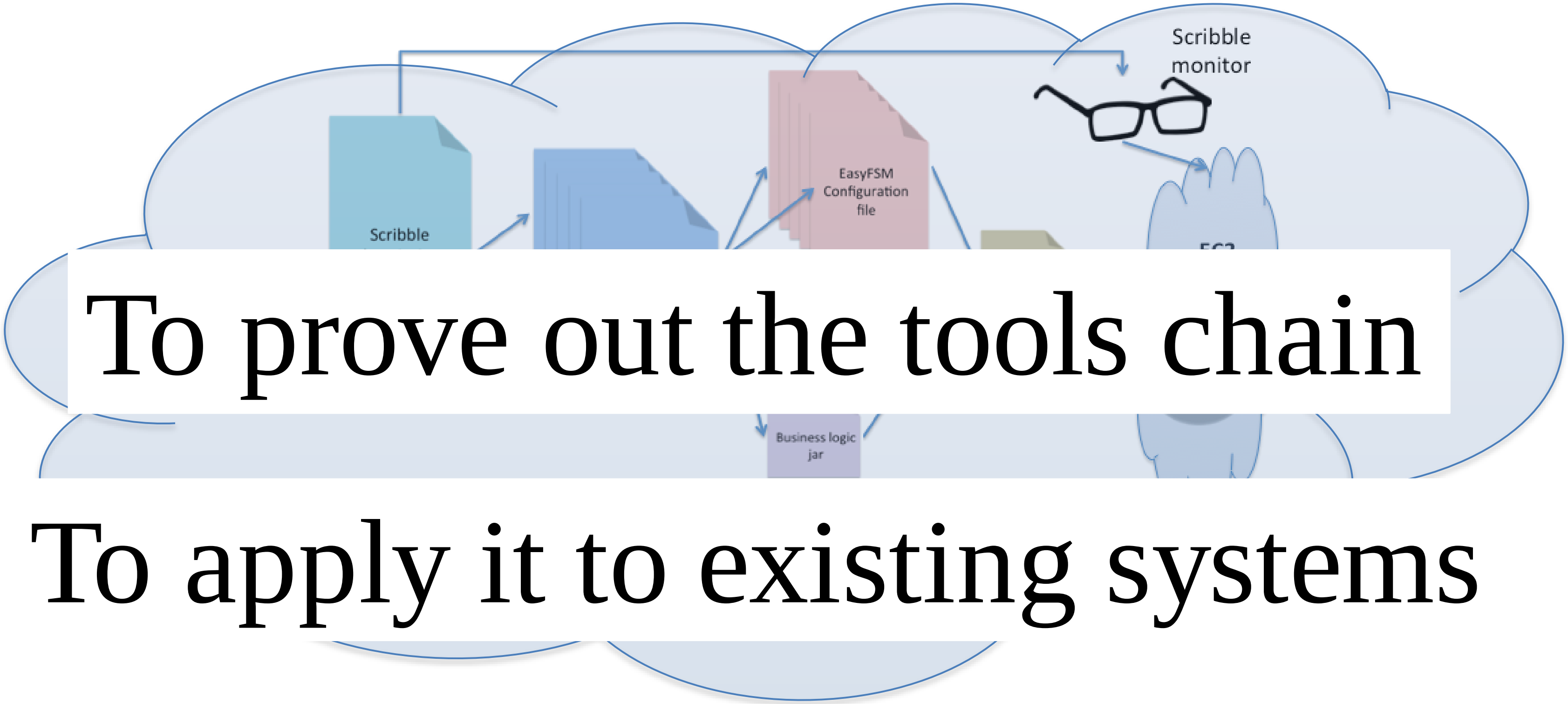
- Capture of tacit knowledge as complexity increases
  - Behavioral correctness of multi-parties (less rework)
- Standing up of stubbed out behaviors
- Reduction in effort and cost to deploy behaviors
  - Behavioral on-the-fly instantiation

This is the
serverless architectures

cribble choreography
using µServices

June 17, 2016: "The Evolution of Microservices," Adrian Cockroft - https://learning.acm.org/webinar/

But that is not enough



To prove out the tools chain

To apply it to existing systems

But that is not enough

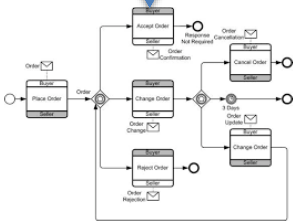
We have to be able to **understand what we have**. The legacy issue.

And we need to understand it just enough to **make sensible decisions**.

So we need be able to modeling what we find, and to **analyse** it and have it give us advice on what to do (i.e. where to start first, the scope of what we need to change)

Scribble Sniffer

TODO



Modeling

Analysis

Advice