Introduction to Event Systems & Programming

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Event Processing is computing that performs operations on events.

Common event processing operations include reading, creating, transforming and deleting events.

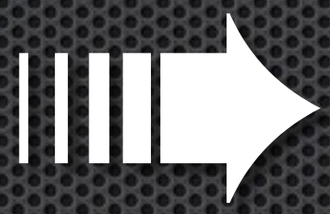
Principle of decoupling

Five Trends Shaping the Future

pages	➠	streams
PC	➠	clouds
html	➠	json
today	➠	now
big data	➠	little data

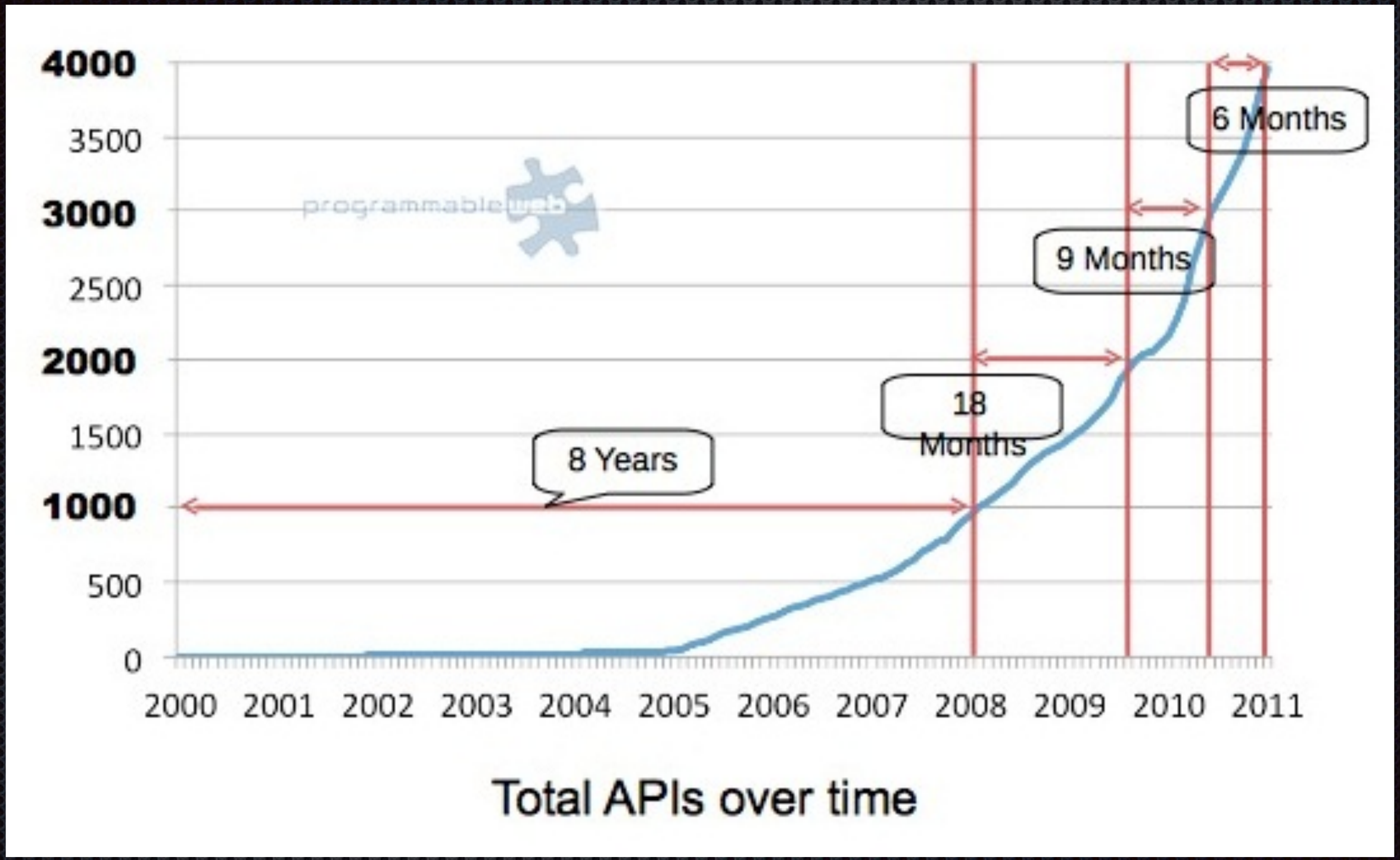
http://itc.conversationsnetwork.org/shows/detail4930.html

Big,
crude,
&
manual...



Small,
measured,
&
automatic

APIs are Everywhere


4000
3500
3000
2500
2000
1500
1000
500
0
programmableweb
6 Months
9 Months
18 Months
8 Years
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
Total APIs over time


Collect
Calls
verizon

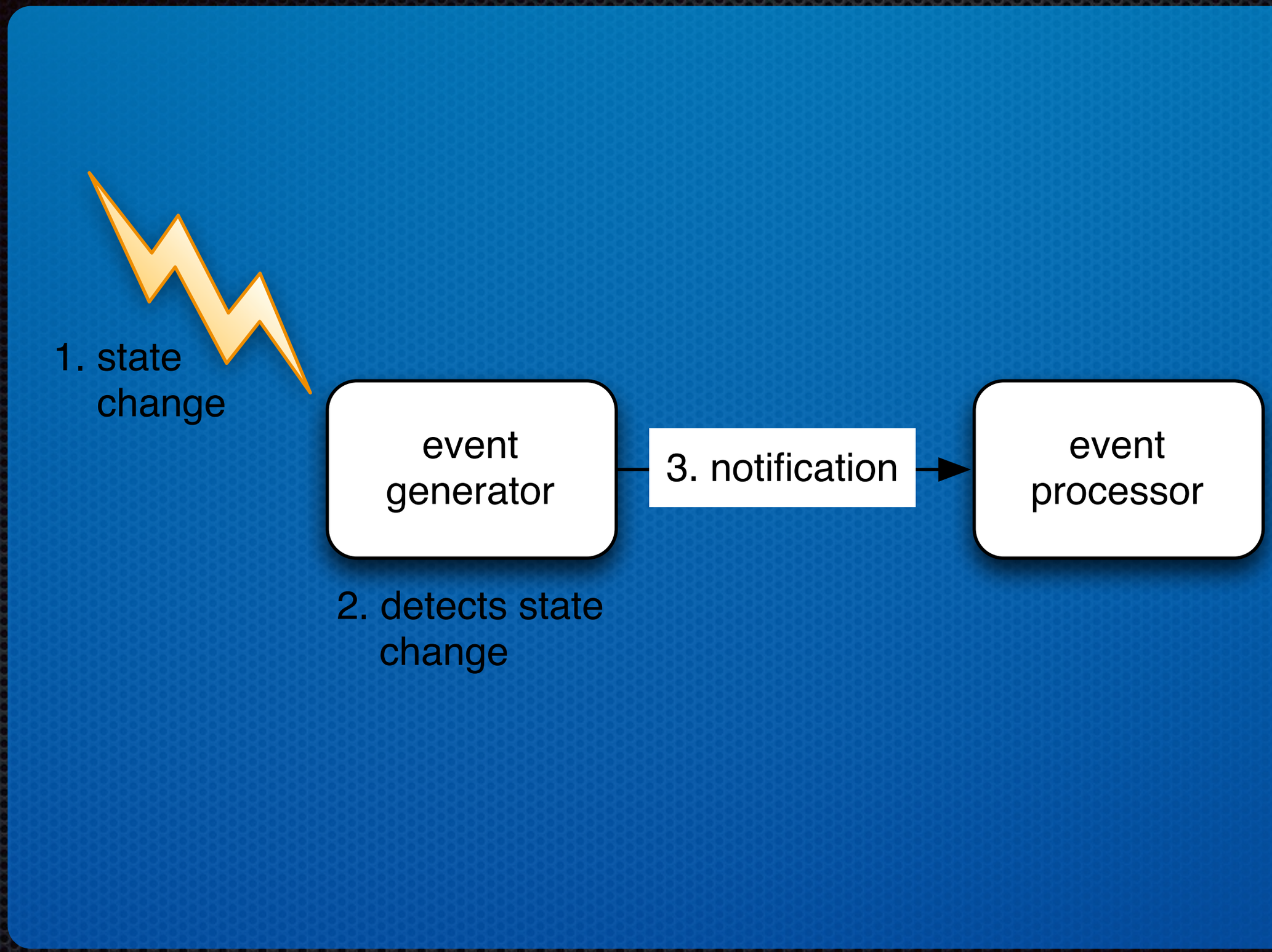
Events Make the Phone Ring

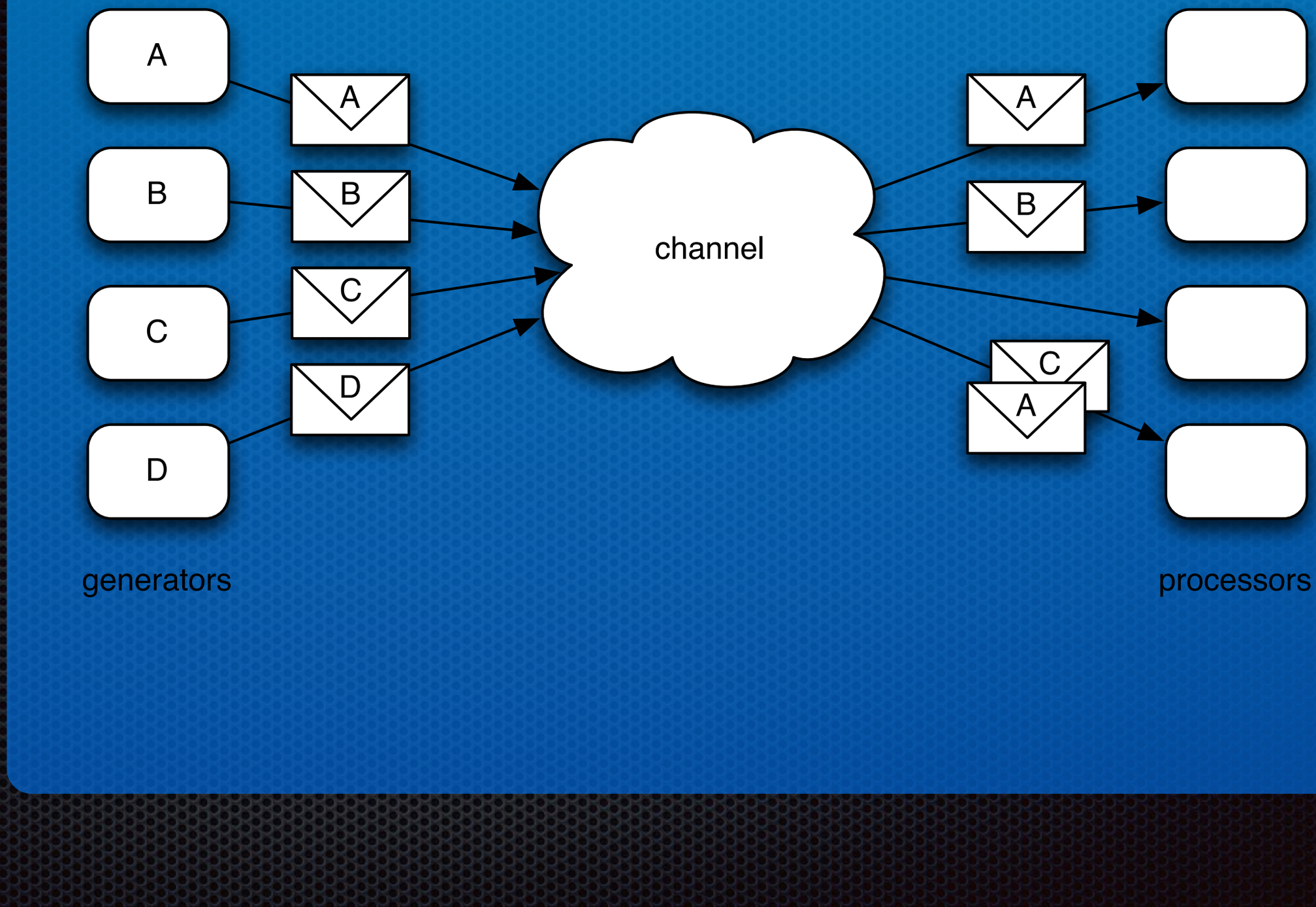
Some APIs Raise Events

- Twilio
- Fitbit
- Foursquare
- Paypal

Event System Components

- Producer/Generator
- Consumer/Processor
- Channel/Bus
- Intermediaries/Agent


1. state change
event generator
3. notification
event processor
2. detects state change


A
B
C
D
A
B
C
D
channel
A
B
C
A
generators
processors

Events enable loosely-coupled, decentralized systems

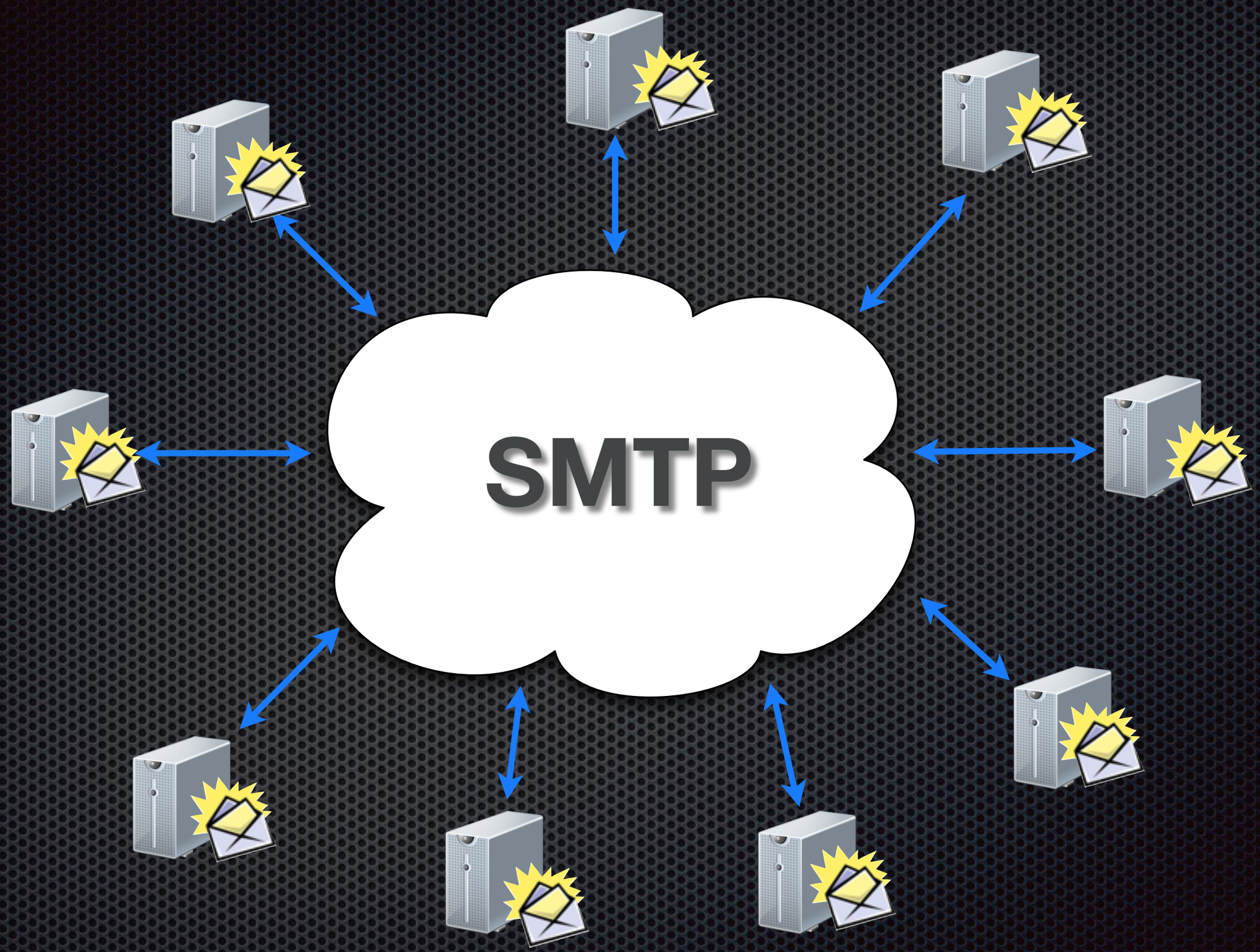
Event System Properties

- Events are autonomous
- Event-driven system are more loosely coupled
- Downstream (receiver) driven flow control
- Near real-time propagation

AOL

MCI

CompuServe


SMTP

Static and Dynamic Systems

	Static Web	Live Web
Interface	Request-response	Event-based
Binding	Early, static	Late, dynamic
References	Procedure call, named	Pattern-based, semantic
Ontology (interpretation)	By prior agreement	Self describing
Interaction	Direct	Brokered
Evaluation (sequencing)	Explicit	Emergent
Behavior	Planned	Reactive
Coordination	Centrally managed	Distributed

todo:new_item()
todo:added_item()
todo:deleted_item()

Mail system

mail:received()

TODO ruleset

event network

email assistant ruleset

TODO system

API calls

events

Programming Evented Systems

Event Based Programming

	Request-Based	**Event-Based**
Signal	Request receipt	Event receipt
Nature	“Do this”	“Something happened”
Obligation	At server	At endpoint (client)
Interpretation	On client	On server

Programming Evented Systems

- Free form
- Stream Based
- Rules
- Inference
- ECA

Rules link events to actions

```
when  an event occurs
if    some condition is true
then  take some action
```

Rule Structure

```
rule <name> {
  select when <eventex>
  pre {
    <declarations>
  }
  if <expr> then
    <action>
  fired {
    <effects>
  } else {
    <effects>
  }
}
```

A Simple Rule

```
rule good_morning {
  select when web pageview
  if time:morning() then
    notify(“welcome!”,
           “Good morning!”
          )
}
```

exampley.com

exampley.com

pwd | Read Later | Google Reader (814) | dev_Good Morning | Readability | Technometria | Other Bookmarks

home, clear, settings, reset, site tag

:) You are free to use this example page for whatever you like.
@MikeGrace published this site after ICANN ruined example.com

Welcome! ×
Good morning!

Event Expressions

```
select when web pageview
```

```
select when web pageview
url#/archives/\d{4}/#
```

Alternatively...

```
rule url_in_condition {
  select when pageview
   if event:attr("url").match(
        #/archives/\d{4}/#
      )
  then notify(...)
}
```

```
select when web pageview
  where url.extract(
    #/archives/(\d{4})/#) > 2003
```

```
select when bank withdrawal
    where amount > 100
```


Radio Thermostat
SAVE ENERGY
6:35 PM
DAY
AUTO
RADIO
LINK
65.5 °F
Tu
62 °F
TARGET TEMP
MODE
MENU
FAN
PROG

```
rule set_average_temperature {
  select when thermostat new_temperature
  pre {
    temperature = event:attr("temperature");
    tl = ent:temps.length();
    new_array =
      (tl == 5) =>
          ent:temps.tail().append(temperature) |
      (tl == 0) =>
          [temperature]                        |
      // else
          ent:temps.append(temperature)        ;
    avg_temp = average(new_array);
  }
  always {
    set ent:temps new_array;
    set ent:avg_temp avg_temp
  }
}
```

```
select when repeat 5
  (thermostat new_temperature
    temperature re/(.*)/)
avg(avg_temp)
```

```
select when
    twilio inbound_call from #(.*)#
      setting (num)
  after
    twilio sms_received
      from.match(“#”+num+”#”)
within 1 hour
```

Event Federation:
The On-Call TA

Class Cloud

On-call TA Dispatcher

Twilio

subscription

schedule:inquiry

TA Clouds

On Call: Demo

Notify

Tuesday 9

calendar

pdm

SMS

SMS

Student Phone

TAs' Phones

Personal Cloud Federation for TAs

```
teaching_assistants =
   [{"name":"Anne",
     "phone":"801362XXXX",
     "eci":"072a3730-2e9a-012f-d2da-00163e411455",
     "calendar":"http://www.google.com/calendar/...
    },
    {"name":"John",
     "phone":"801602XXXX",
     "eci":"fc435280-2b60-012f-cfeb-00163e411455",
     "calendar":"http://www.google.com/calendar/...
    }
    ...
];
```

```
rule dispatch {
  select when schedule inquiry
    foreach teaching_assistants setting (ta)
      event:send(ta,"schedule","inquiry")
        with attrs =
          {"from" : event:attr("From"),
           "message": event:attr("Body"),
           "code": math:random(99);
          };
      always {
        raise explicit event
            subscribers_notified
            on final
      }
}
```

Personal Cloud OS

myCloud myConnections myThings myApps appStore

myProfile

Name: Steve Fulling

Email: swf@kynetx.com

Phone: 801.555.1234

Photo

Choose file

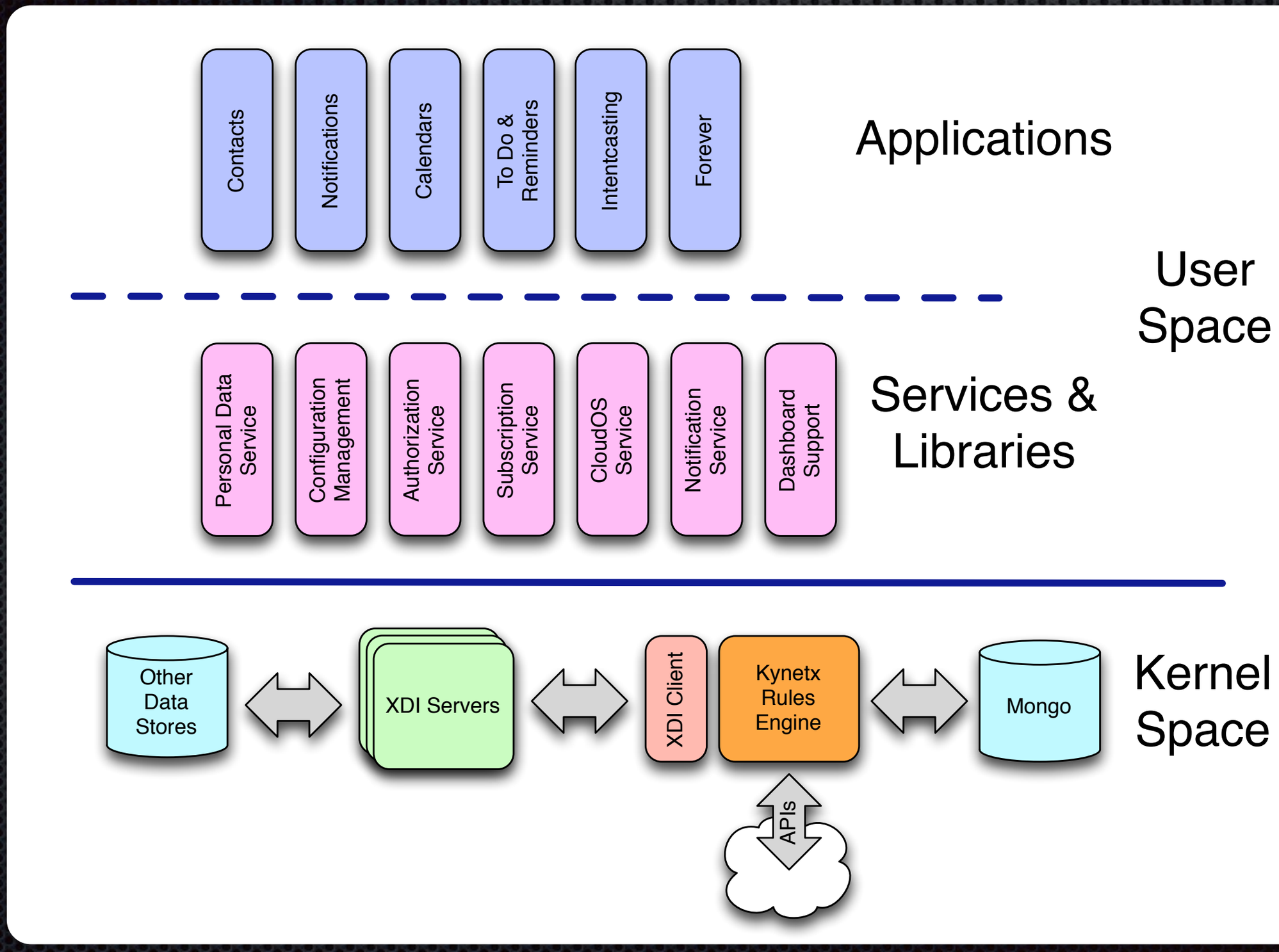
Save Changes

TUESDAY 9 OCTOBER 2012

11:10:38

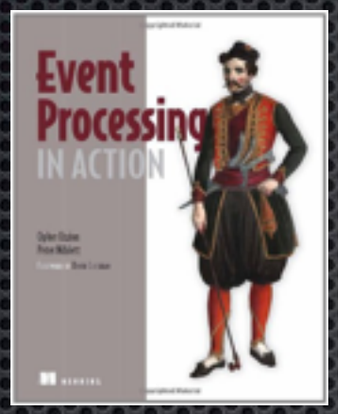
Powered by Kynetx

Personal Cloud OS



Event Processing Books

The Live Web
Phillip J. Windley



Event Processing in Action
Etzion & Niblett

Event Processing
Chandy & Schulte