

# The Emergence of the Datacenter Developer

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[@superguenter](#)



# A Brief History of Operating Systems



1950's

Punchcards

No operating systems

Time Sharing

Computing as a utility





# 1960's UNIX

Small, composable programs

Machine-independent  
language (C)

Multitasking & Multiuser

Everything is a file

Shell





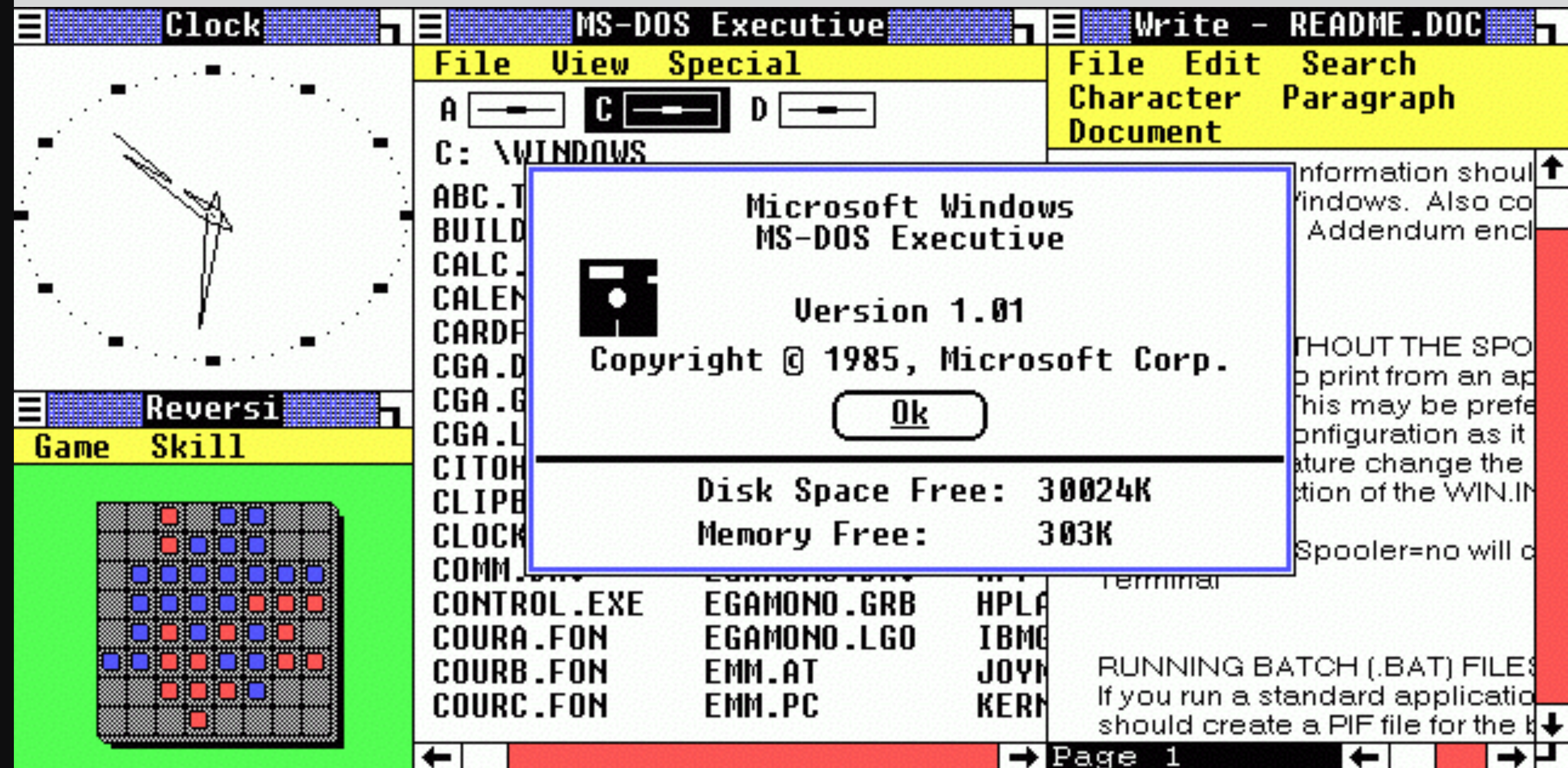
# 1980's PC OS

Windows, Mac OS, Amiga

GUI

Mouse

Virtual Memory





2000's

# Mobile OS

iOS, Android

Touchscreen

Camera

GPS, Accelerometer



2010's

# Datacenter OS


Apache Mesos

Linux Containers


Cluster Scheduling


API for the Datacenter







Datacenter Name  
172.03.12.1

 Dashboard

 **Services**

 Datacenter



Mesosphere DCOS v1.6

Open Command Line

## Services

CPUMemoryDisk

Disk Allocation Per Minute  
38 Total Services

MinuteHour



38 Total Services

All 38Healthy 24Sick 7Filter

☐   
marathon-development  
Healthy (37 Tasks)  
Marathon v.1.0.2

☒   
marathon-production  
Healthy (14 Tasks)  
Marathon v.1.0.2

☐   
spark-financial-forecasin...  
Sick (401 Tasks)  
Spark v.1.2.1

☐   
kubernetes-p...  
Healthy (56...  
Kubernetes

☐ 

☐ 

☐ 

☐ 

# The Datacenter Developer



# The Datacenter Developer

A developer who uses an SDK to build distributed systems that can dynamically leverage all the resources available in a datacenter.

Building Distributed Systems

# Without Apache Mesos

Application Code

Scheduler

Task Management

Monitoring

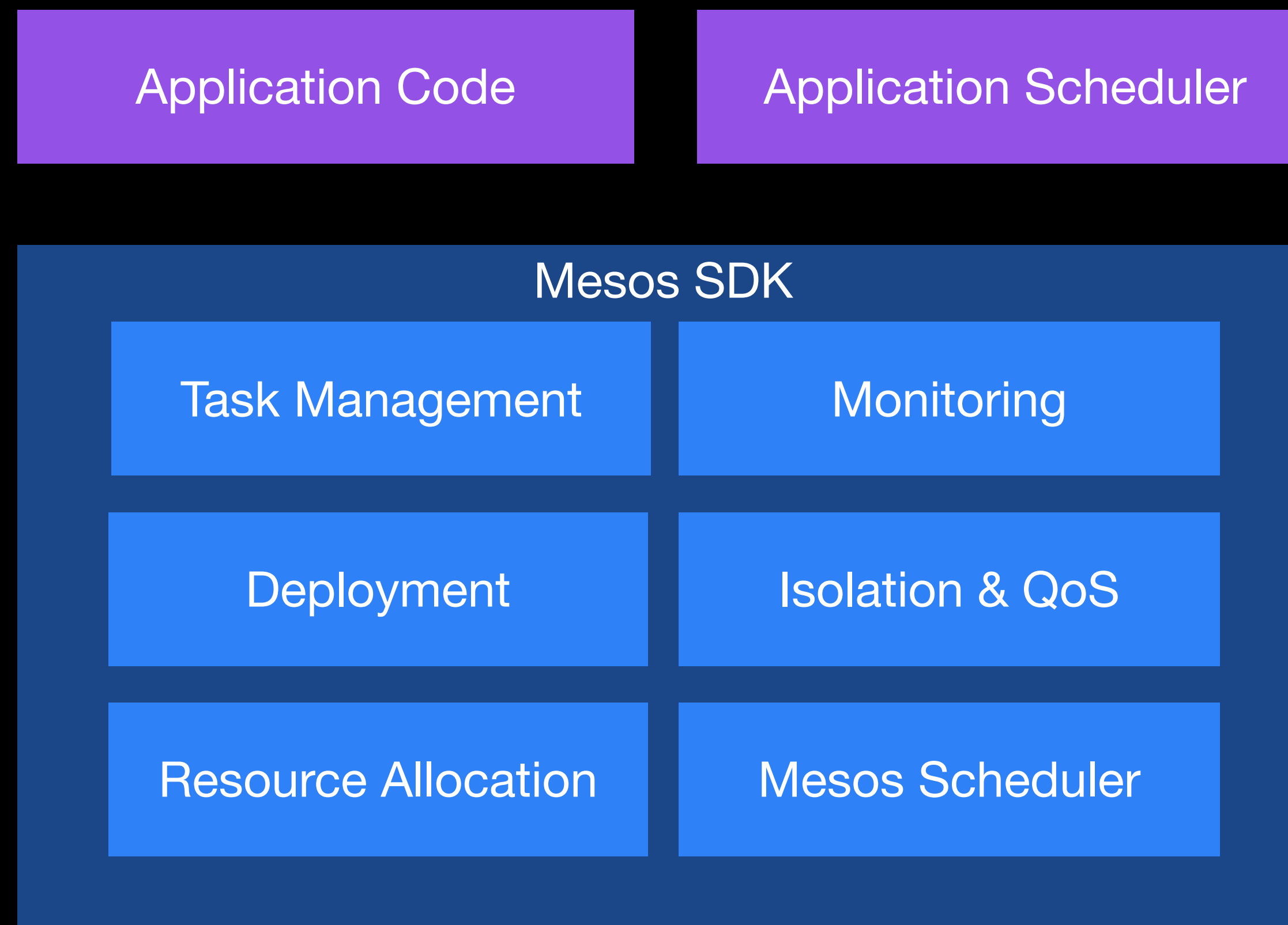
Deployment

Isolation & QoS

Resource Allocation



# Building Distributed Systems With Apache Mesos



A Datacenter Developer has ...

... more Time to focus on her Application

Hard distributed systems problems are already solved by Mesos

High level APIs allow developers to be more productive

Task and Executor APIs provide a model similar to processes



A Datacenter Developer uses ...

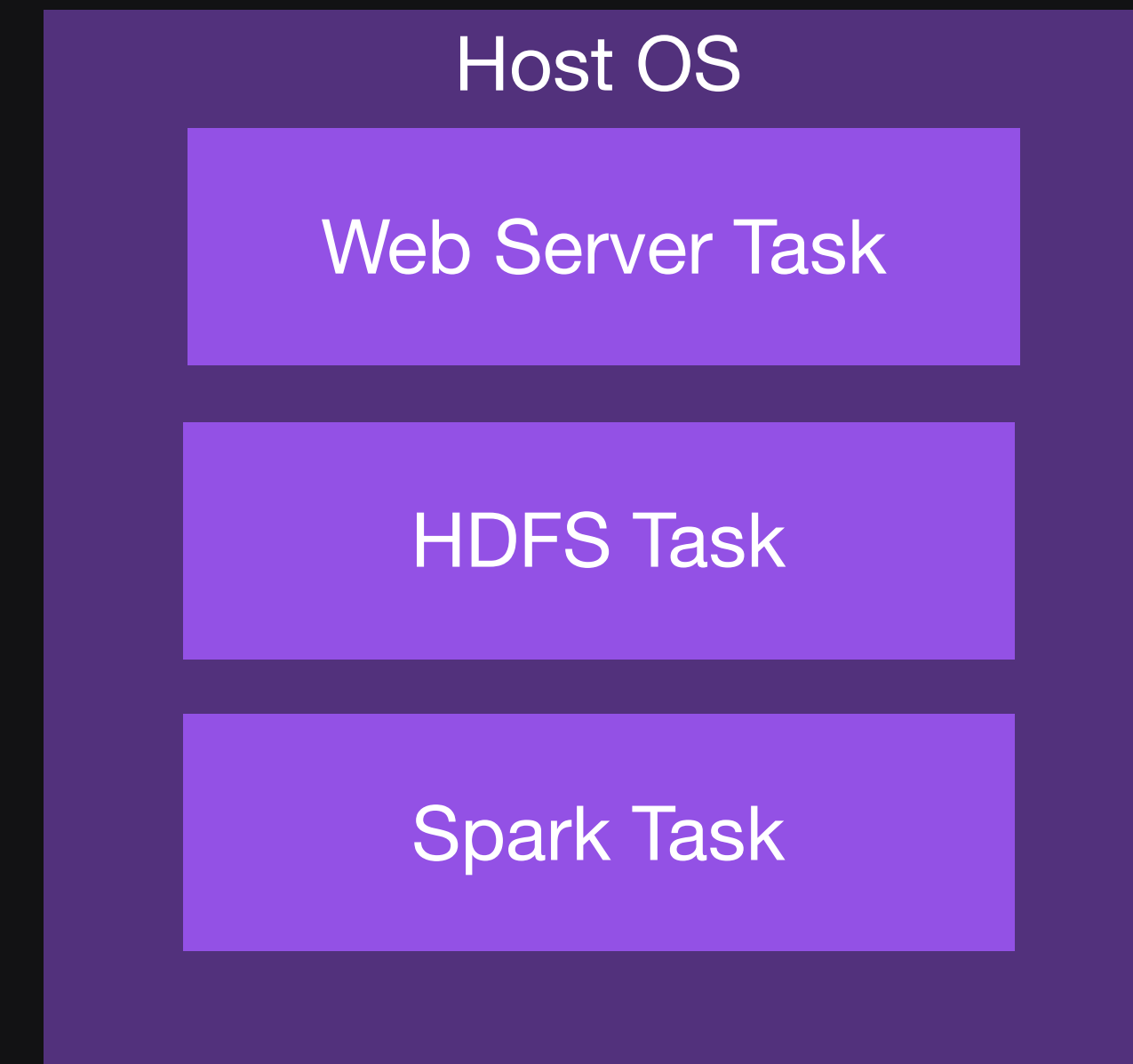
# ... Containers to isolate Tasks

Time share of CPU

Memory/pid/user namespace

Chroot

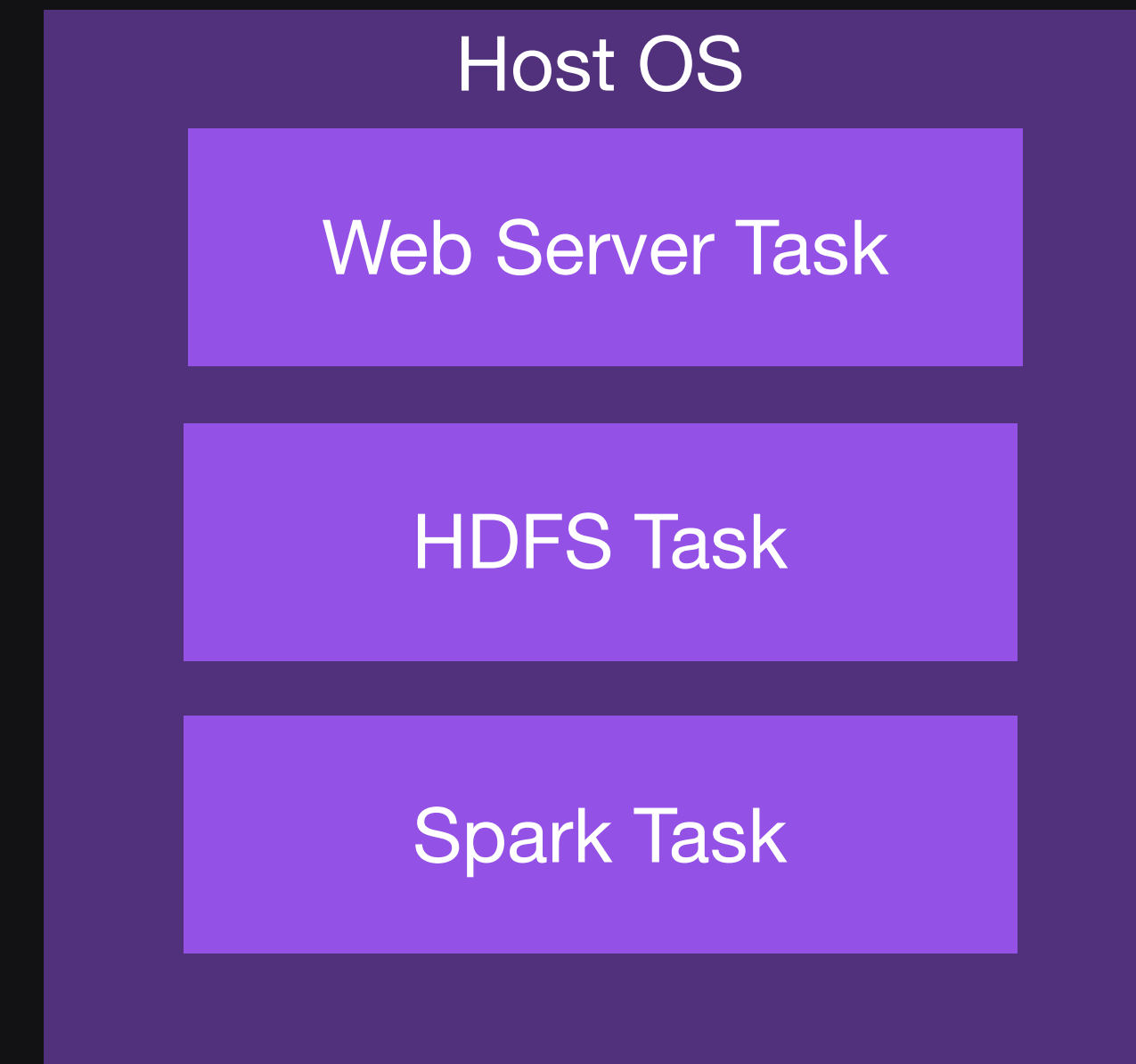
Disk and network QoS



A Datacenter Developer can ...

... run her apps next to the data

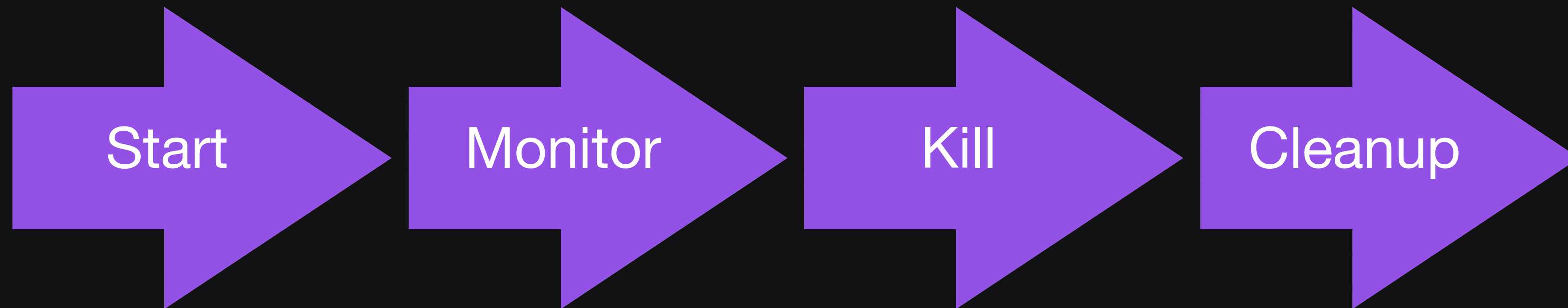
Data-heavy applications can run  
where the data is stored.





A Datacenter Developer gets ...

... task lifecycle management



A Datacenter Developer gets ...

... task metadata

```
TaskInfo {  
  task_id: "myapp.45b70272-d88c-11e4-98ef-a689777343be",  
  labels: {  
    environment: "production",  
    owner: "tobi@mesosphere.io"  
  }  
}
```



A Datacenter Developer gets ...

... task metadata

```
TaskInfo {  
  task_id: "myapp.45b70272-d88c-11e4-98ef-a689777343be",  
  discovery: {  
    visibility: EXTERNAL,  
    ports: [  
      { number: 80, name: "http", protocol: "TCP" }  
    ]  
  }  
}
```

A Datacenter Developer can ...

... easily respond to failures

Machine and task failure detection

Health checks: HTTP, TCP, or custom program

Every part of Mesos is fault tolerant



A Datacenter Developer gets ...

... notified of failed tasks

```
TaskStatus {  
  task_id: "dispatch.45b70272-d88c-11e4-98ef-a689777343be",  
  state: TASK_FAILED,  
  source: SOURCE_SLAVE,  
  reason: REASON_COMMAND_EXECUTOR_FAILED,  
  message: "Command exited with status 1"  
}
```

A Datacenter Developer gets ...

... notified when tasks run out of memory

```
TaskStatus {  
  task_id: "dispatch.45b70272-d88c-11e4-98ef-a689777343be",  
  state: TASK_FAILED,  
  source: SOURCE_SLAVE,  
  reason: REASON_MEMORY_LIMIT,  
  message: "Task exceeded its memory limit"  
}
```



A Datacenter Developer gets ...

... notified of failing machines

```
TaskStatus {  
  task_id: "dispatch.45b70272-d88c-11e4-98ef-a689777343be",  
  state: TASK_LOST,  
  source: SOURCE_MASTER,  
  reason: REASON_SLAVE_DISCONNECTED,  
  message: "Slave disconnected"  
}
```

A Datacenter Developer gets ...

... easy access to logs

```
$ mesos tail -f poseidon.*
```

```
==>poseidon.4729069a-d87d-11e4-8cee-f20d55470486:stdout<==
```

```
[2015-04-07 19:37:23,842] INFO 104.236.41.240 - - [07/Apr/2015:19:37:23 +0000] "GET /ping HTTP/1.1"
```

```
[2015-04-07 19:37:33,915] INFO 104.236.41.240 - - [07/Apr/2015:19:37:33 +0000] "GET /ping HTTP/1.1"
```

```
[2015-04-07 19:37:43,877] INFO 104.236.41.240 - - [07/Apr/2015:19:37:43 +0000] "GET /ping HTTP/1.1"
```

```
[2015-04-07 19:38:44,037] INFO 104.236.41.240 - - [07/Apr/2015:19:38:43 +0000] "GET /ping HTTP/1.1"
```

```
[2015-04-07 19:38:54,004] INFO 104.236.41.240 - - [07/Apr/2015:19:38:53 +0000] "GET /ping HTTP/1.1"
```

```
==>poseidon.15bb96b9-d63a-11e4-93c0-f6e64c94ec3c:stdout<==
```

```
[2015-04-07 19:37:23,905] INFO 104.236.41.240 - - [07/Apr/2015:19:37:23 +0000] "GET /ping HTTP/1.1"
```

```
[2015-04-07 19:37:33,891] INFO 104.236.41.240 - - [07/Apr/2015:19:37:33 +0000] "GET /ping HTTP/1.1"
```

```
[2015-04-07 19:37:43,924] INFO 104.236.41.240 - - [07/Apr/2015:19:37:43 +0000] "GET /ping HTTP/1.1"
```

```
[2015-04-07 19:38:44,022] INFO 104.236.41.240 - - [07/Apr/2015:19:38:43 +0000] "GET /ping HTTP/1.1"
```

```
[2015-04-07 19:38:54,042] INFO 104.236.41.240 - - [07/Apr/2015:19:38:53 +0000] "GET /ping HTTP/1.1"
```

A Datacenter Developer gets ...

... powerful resource monitoring

```
$ curl http://localhost:5051/monitor/statistics.json
{
  "statistics": {
    "cpus_system_time_secs": 154.42,
    "cpus_user_time_secs": 258.74,
    "mem_file_bytes": 30613504,
    "mem_rss_bytes": 140341248,
    "net_rx_bytes": 2402099,
    "net_tx_bytes": 1507798,
    "net_tx_dropped": 0,
    "net_tx_errors": 0,
    . . .
  }
}
```



A Datacenter Developer...

... programs against a whole datacenter

No longer program against machines, but fungible resources

Developers only need to know WHAT they need, not HOW to get it

Allocate more resources on existing machines or populate new ones via an API

A Datacenter Developer can ...  
... scale elastically

Populating new cluster nodes is baked in

Mesos fetches the code via HTTP, HDFS, or Docker

Can also be used to deploy config, models, etc.

A Datacenter Developer can ...

... build her own cluster scheduler easily

Mesos has a two level scheduler

Dominant Resource Fairness (DRF) provides fair resource allocation

Applications implement their own specialized scheduling logic



# Projects built on top of Mesos

# Apache Projects ported to Mesos



Apache Kafka



Apache YARN (Myriad)

Apache HDFS

Apache Storm

# Other Projects ported to Mesos



**Jenkins**



**elastic**



**CRATE**

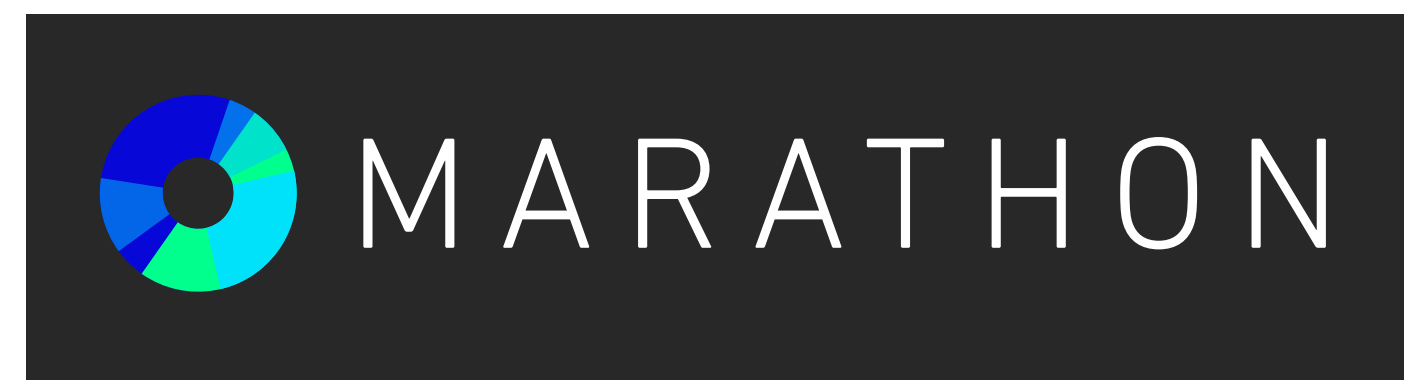


**ArangoDB**

# Projects built directly on Mesos



**CHRONOS**





An Example

# A modern Web App built entirely on Mesos

Twitter

# Anatomy of a Web App

Millions of users

Lots of data

Data products

A screenshot of the Twitter web application interface. The left sidebar contains navigation links: "Who to follow", "Trends", and a footer with copyright and policy links. The main content area shows a user profile for Tobi Knaup (@superguenter) and a list of tweets. The tweets include a congratulatory message for @derrickharris, a link to an article about The Bold Italic, a link to a rare sunrise, a link to a truck screening, and a retweet of a tweet about a dystopian FBI document. The right sidebar contains a "What's happening?" search bar and a "View 2 new Tweets" link.

Twitter

# Anatomy of a Web App

Millions of users

Lots of data

Data products

mesosphere

Who to follow · Refresh · View all

**Peter Schuller** @scode  
Follow

**Mats Linander** @matslina  
Follow

Popular accounts · Find friends

Trends · Change

#NationalBeerDay  
Rand Paul  
HBO Now  
#WorldHealthDay  
The Bold Italic  
#BadChoiceFuneralSongs  
Deus Ex  
#ScotDebates  
#NCAACHampionship  
Arrested Development

© 2015 Twitter About Help Terms Privacy  
Cookies Ad info Brand Blog Status Apps

What's happening?

View 2 new Tweets

**Alex Williams** @alexwilliams · 2m  
Congrats to @derrickharris, formerly of @gigaom, who is joining @mesosphere as a senior research analyst.

**Zed** @zedshaw · 6m  
The Bold Italic folds [thebolditalic.com/articles/7229-...](#) Next up, The <em>Comic Sans magazine about Duluth, and The Mono Arial about Topeka.

**Dennis Goedegebuure** @TheNextCorner · 7m  
Rare Sunrise Blood Moon This Weekend [bit.ly/1NFO3pg](#)

**Interstate 80 Tahoe** @i80chains · 7m  
OPEN: Trucks Screened (14:32 04/07)

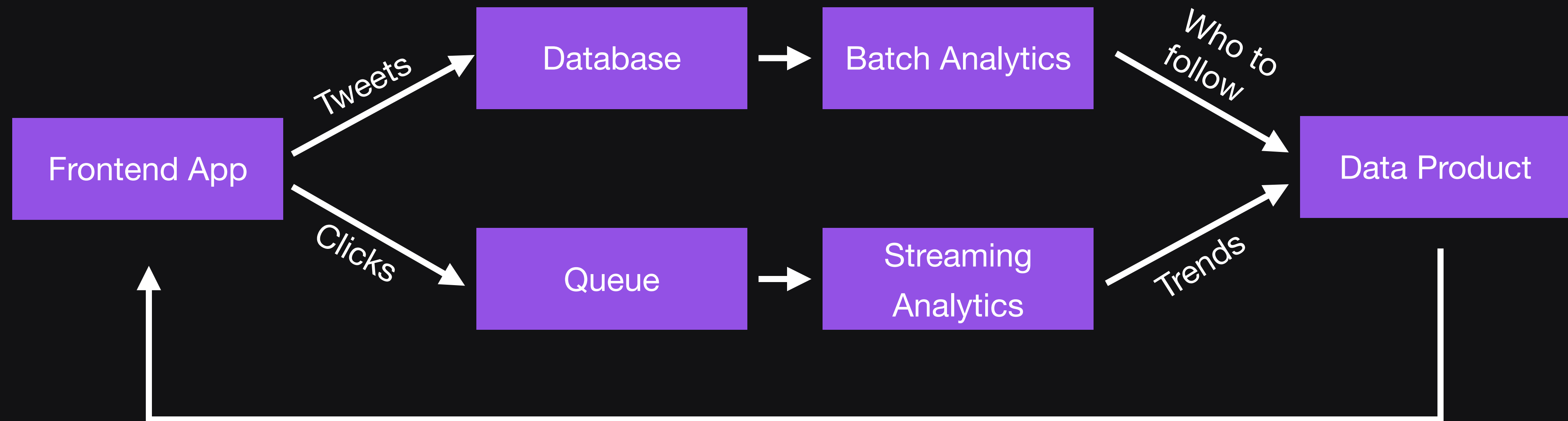
**Nicholas Weaver** @lynxbat · 9m  
I'm not smart enough for this room.

Zed retweeted  
**Sarah N. Emerson** @SarahNEmerson · 23m  
The dystopian FBI document used to keep spy technology hidden [motherboard.vice.com/read/the-dysto...](#)

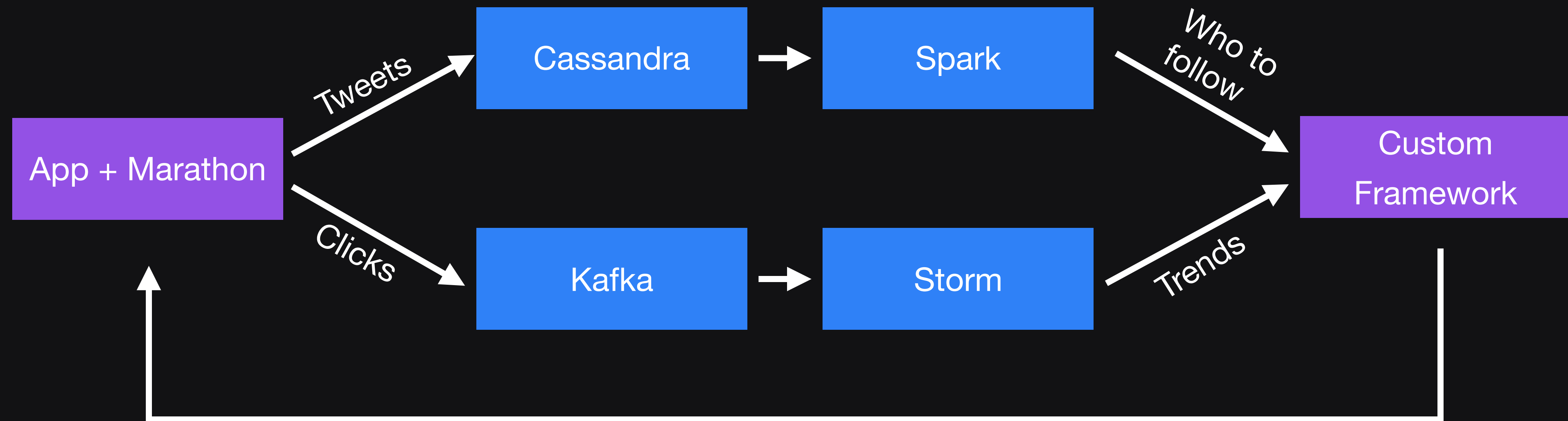
Police are not allowed to talk about the technology in press releases, in court documents, during judicial hearings, or during other public forums or proceedings."

- If a district prosecutor intends to use details about how the Stingray works during a court case, police must alert the FBI "in order to allow sufficient time for

# Anatomy of a Web App



# Anatomy of a Web App - entirely on Mesos





Links to get you started

# Become a Datacenter Developer!

App Development Guide: <https://mesos.apache.org/documentation/latest/app-framework-development-guide/>

Mesos Protobuf Messages: <https://github.com/apache/mesos/blob/master/include/mesos/mesos.proto>

Learning Framework (RENDLER): <https://github.com/mesosphere/RENDLER>

Language Bindings

# Become a Datacenter Developer!

Go: <https://github.com/mesos/mesos-go>

Akka/Scala: <https://github.com/drexin/akka-mesos>

Clojure: <https://github.com/dgrnbrg/clj-mesos>

Pure Java: <https://github.com/groupon/jesos>

Pure Python: <https://github.com/wickman/pesos>

Haskell: <https://github.com/iand675/hs-mesos>