SINTEF

Environnement logiciels pour l'informatique mobile

Mobile applications & Cloud Computing

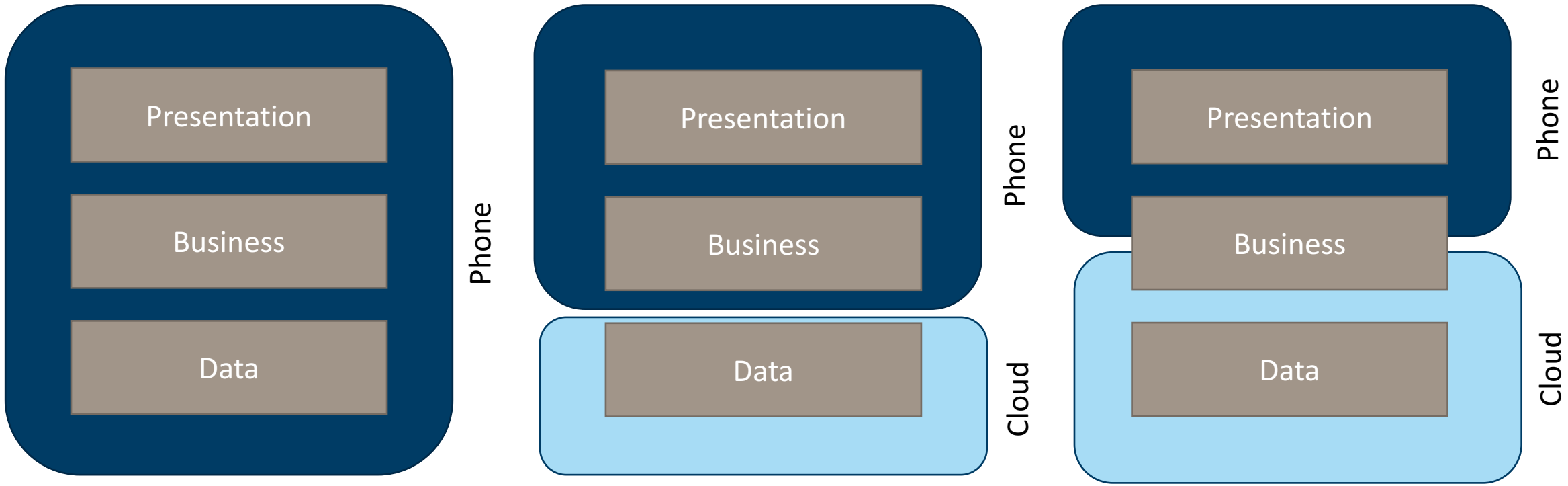
Nicolas Ferry (SINTEF)

10th January 2017

SINTEF

- Trondheim & Oslo, Norway
- Largest research organization in Scandinavia

Mobile apps & Cloud Computing



SINTEF

Cloud computing

"A computing model enabling ubiquitous network access to a shared and virtualised pool of computing capabilities (e.g., network, storage, processing, and memory) that can be rapidly provisioned with minimal management effort"

--source: NIST

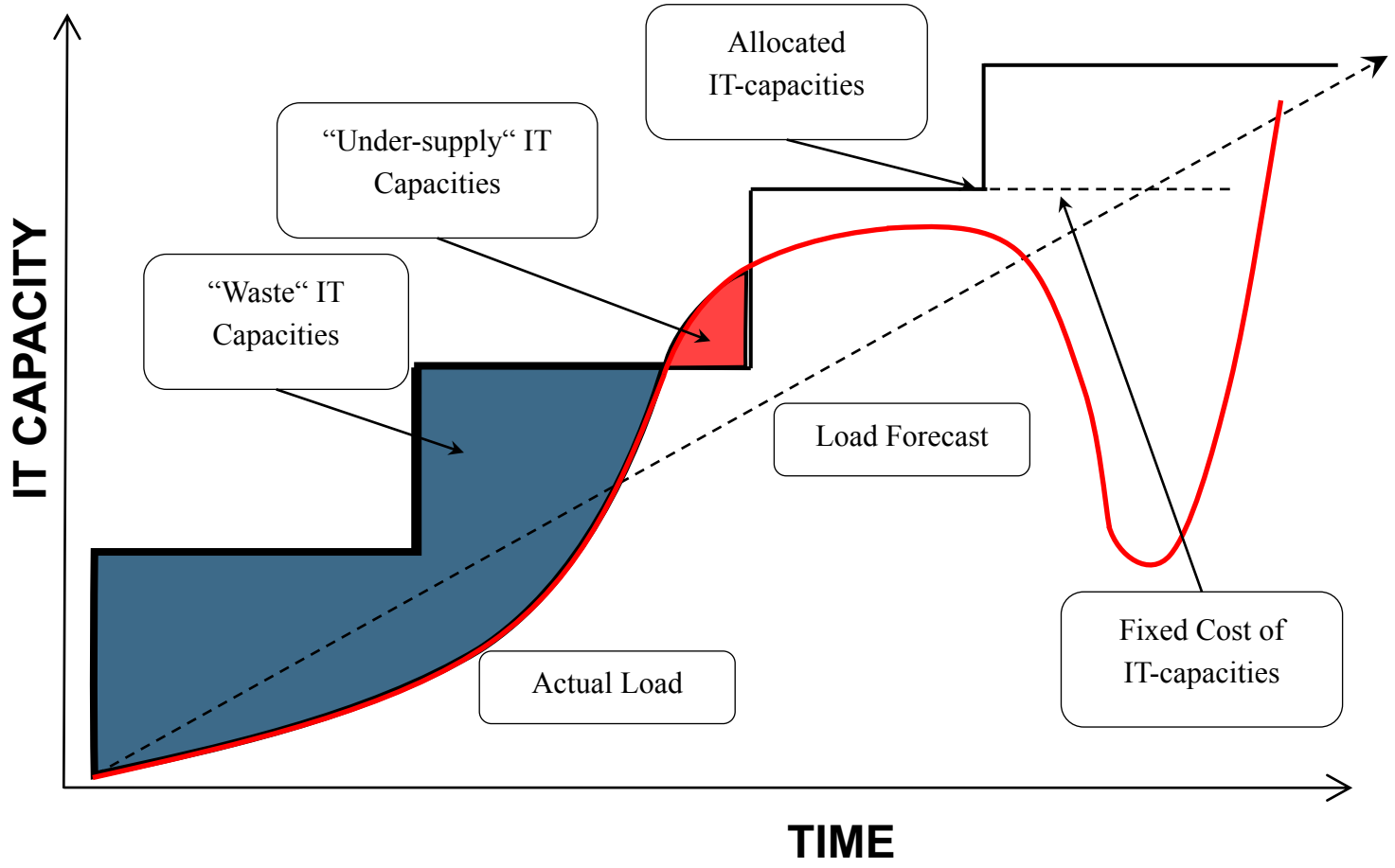
http://youtu.be/QJncFirhjPg

SINTEF

Cloud computing in short

- **Large-scale** and **accessible on demand resources**
  - **Network**
  - **Storage**
  - **Compute**
  - **Software**
- **Available** via Web service calls **through** the **Internet**
- Short- or long-term access on **a pay per use** basis

Optimize IT capacity to the load



Courtesy of Microsoft

SINTEF

Elasticity and Scalability

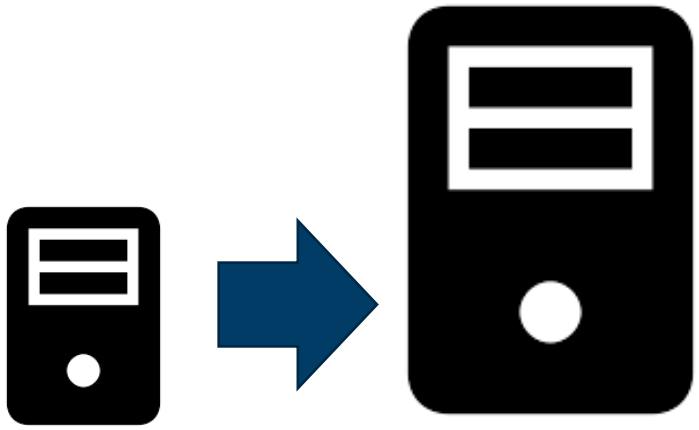
- **Scalability:** the ability of a service to sustain variable workload while fulfilling quality of service (QoS) requirements, possibly by consuming a variable amount of underlying resources.

- **Elasticity:** the ability of a service to rapidly provision and deprovision underlying resources on the fly.

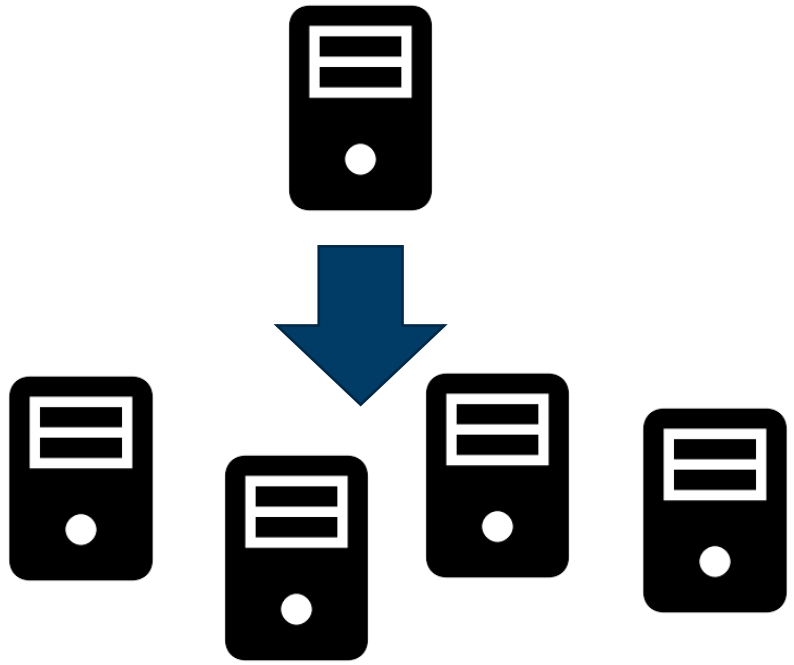
One does not guarantee the other!

Scalability

Vertical



Horizontal



Benefits and challenges

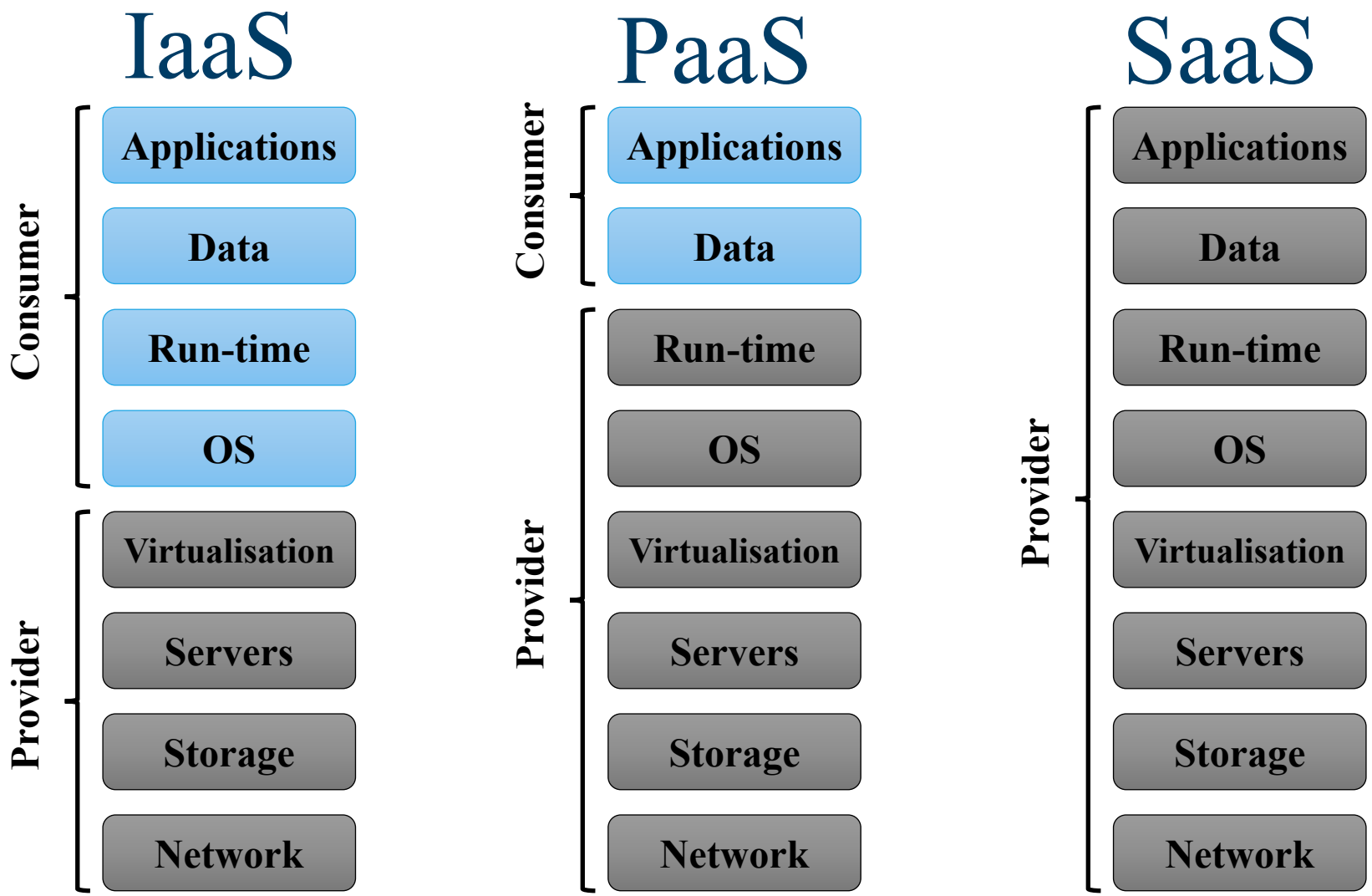
Benefits:

- Scalability
- Performances
- Availability
- Cost?

Challenges:

- Interoperability
- Vendor lock-in
- Legal aspects (e.g., data location, ownership etc.)
- Predictability
- Self-adaptation

The cloud computing stack

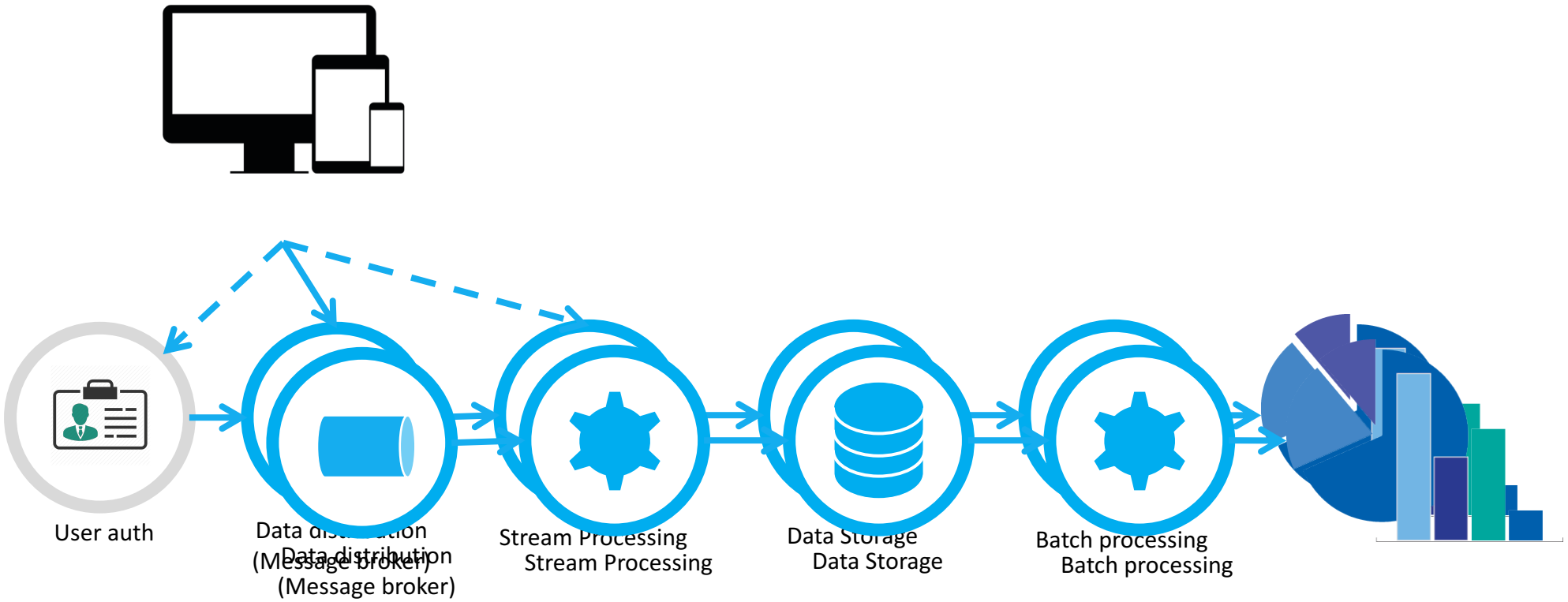


SINTEF

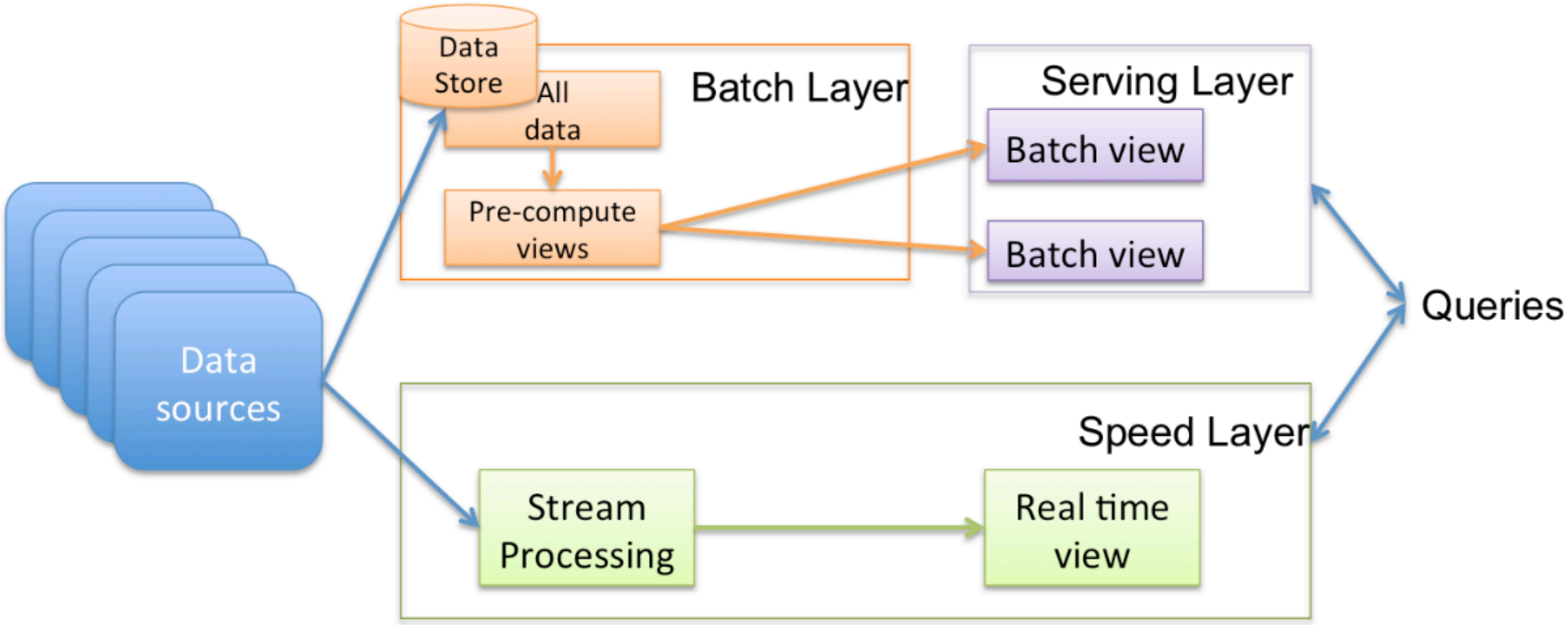
Deployment model

- **Private Cloud**
  - Owned by the organization. Said to be more secure as the storage and processing stays under the organization control
  - E.g., OpenStack, Cloud Foundry
- **Public Cloud**
  - Hosted at the provider premises, who is in charge of its maintenance and management
  - E.g., AWS, Azure
- **Hybrid Cloud**
  - Composition of two or more public and private cloud

Typical Pipeline



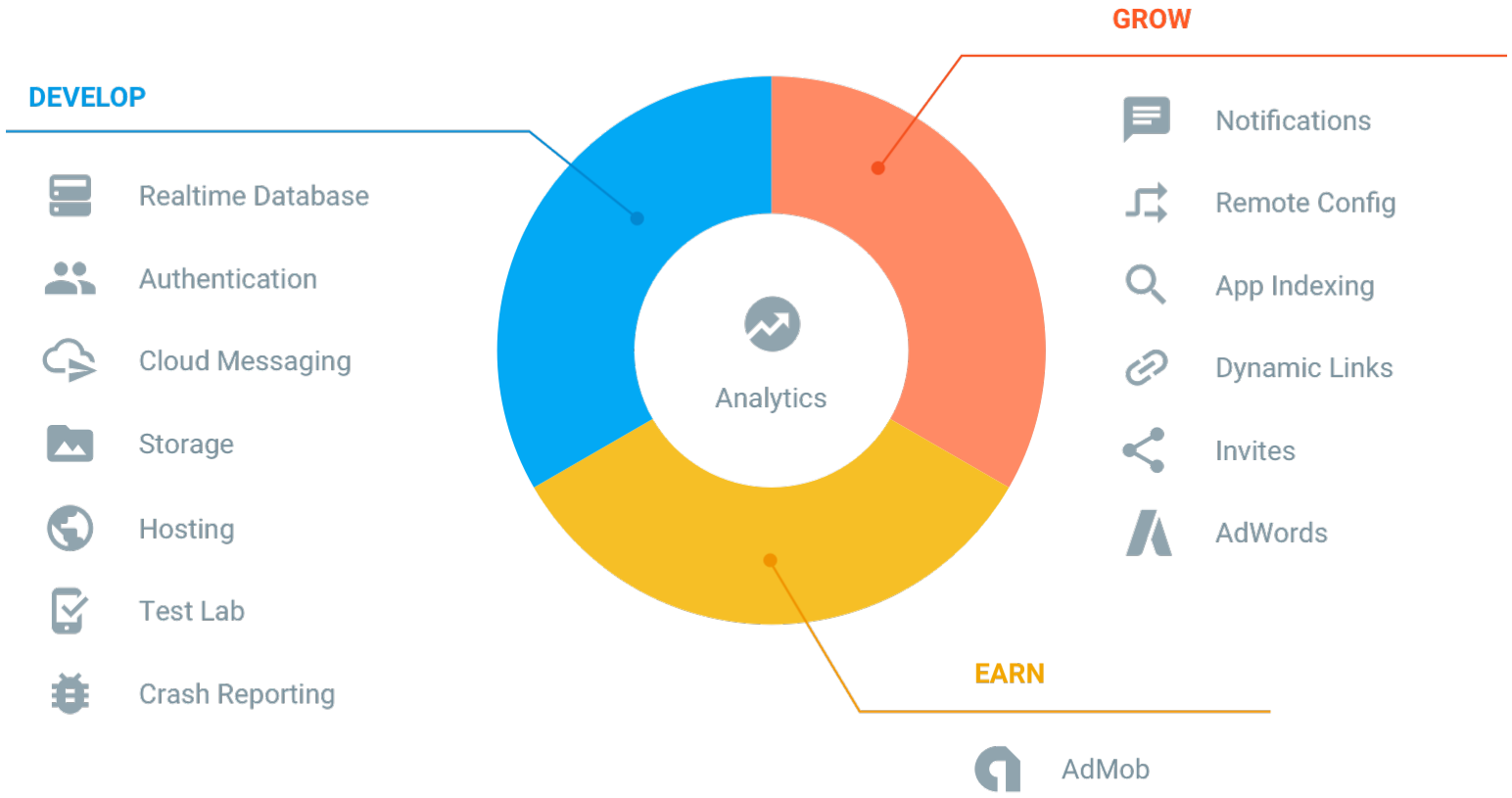
Classical architecture



SINTEF

Some cloud services

- Firebase(https://codelabs.developers.google.com/codelabs/firebase-android/#0)

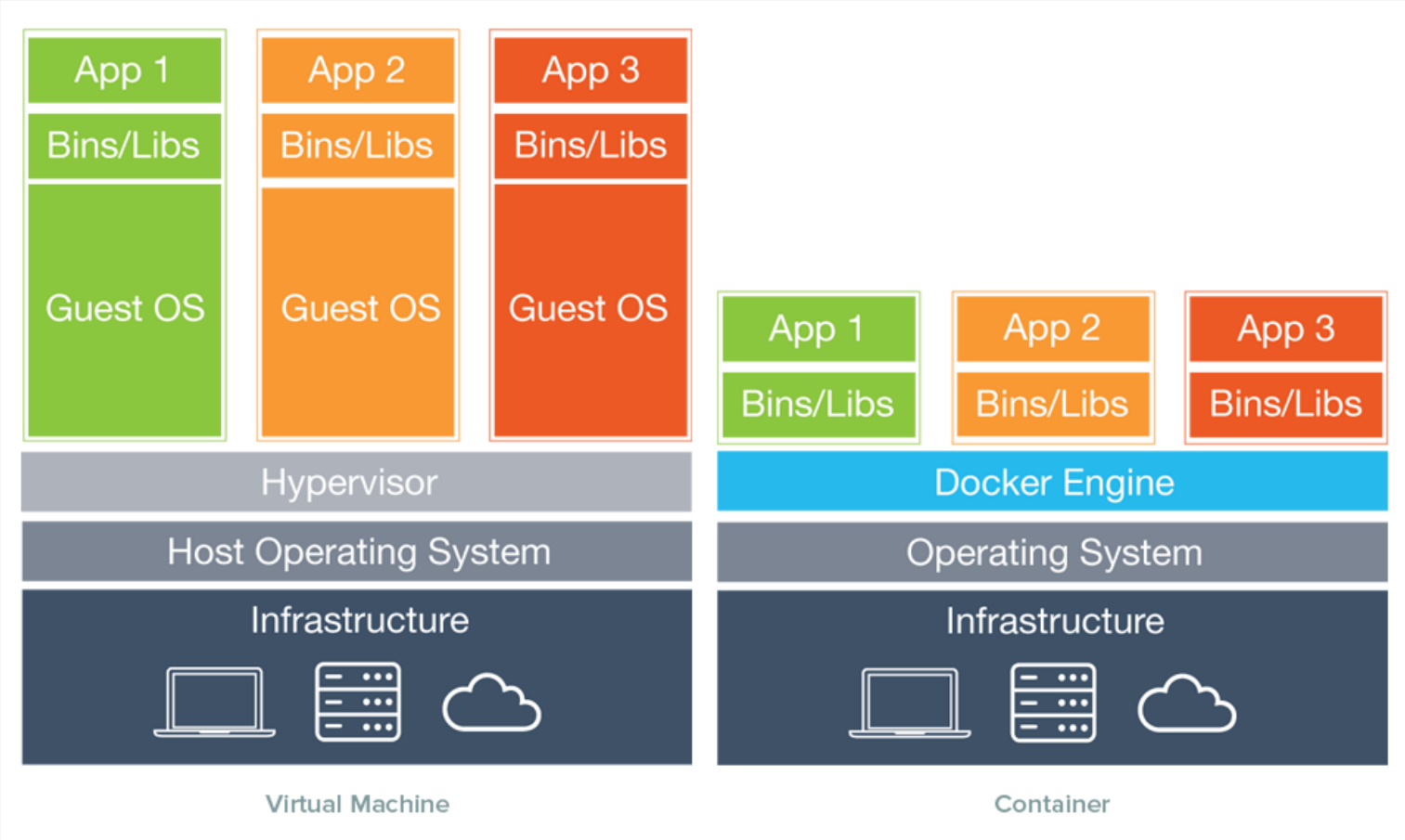


SINTEF

Some cloud services

- AWS Device Farm
  - Test your app against mobile devices in the cloud!
- AWS S3
  - File storage
- AWS DynamoDB
  - No-SQL database
- AWS Pinpoint
  - Push notifications
- AWS Cognito
  - Authentication service
- AWS IoT
  - Software suite for building IoT apps

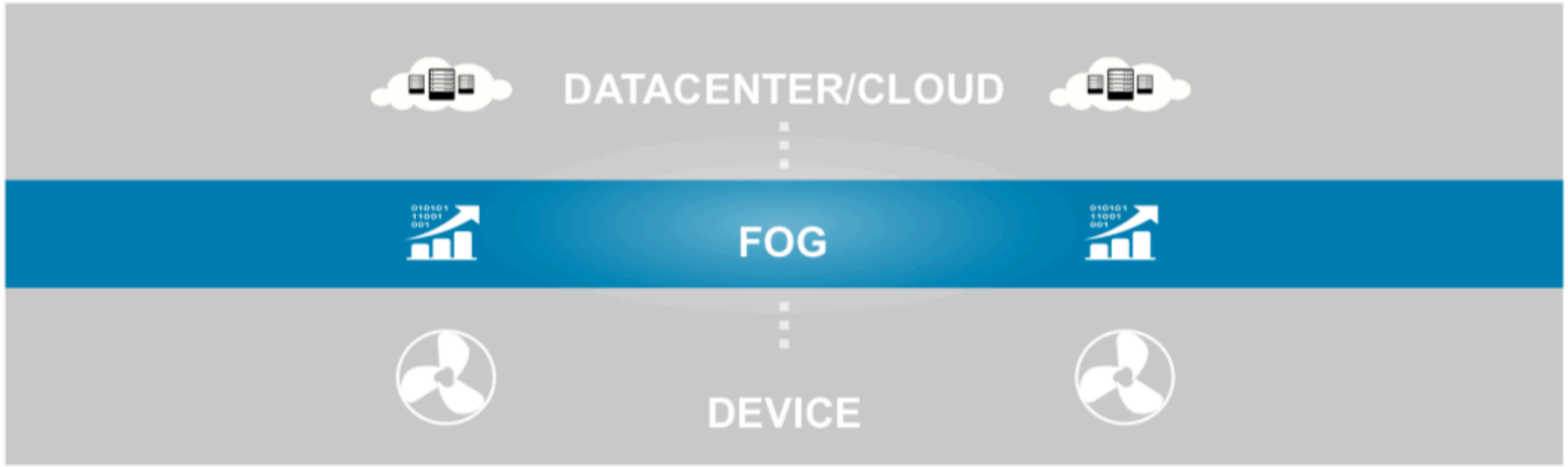
Containers



http://blog.infinit.sh/the-missing-piece-in-containers-storage/

SINTEF

Fog Computing



[Cisco] Fog Computing and the Internet of Things: Extend the Cloud to Where the Things Are

SINTEF

Why fog computing?

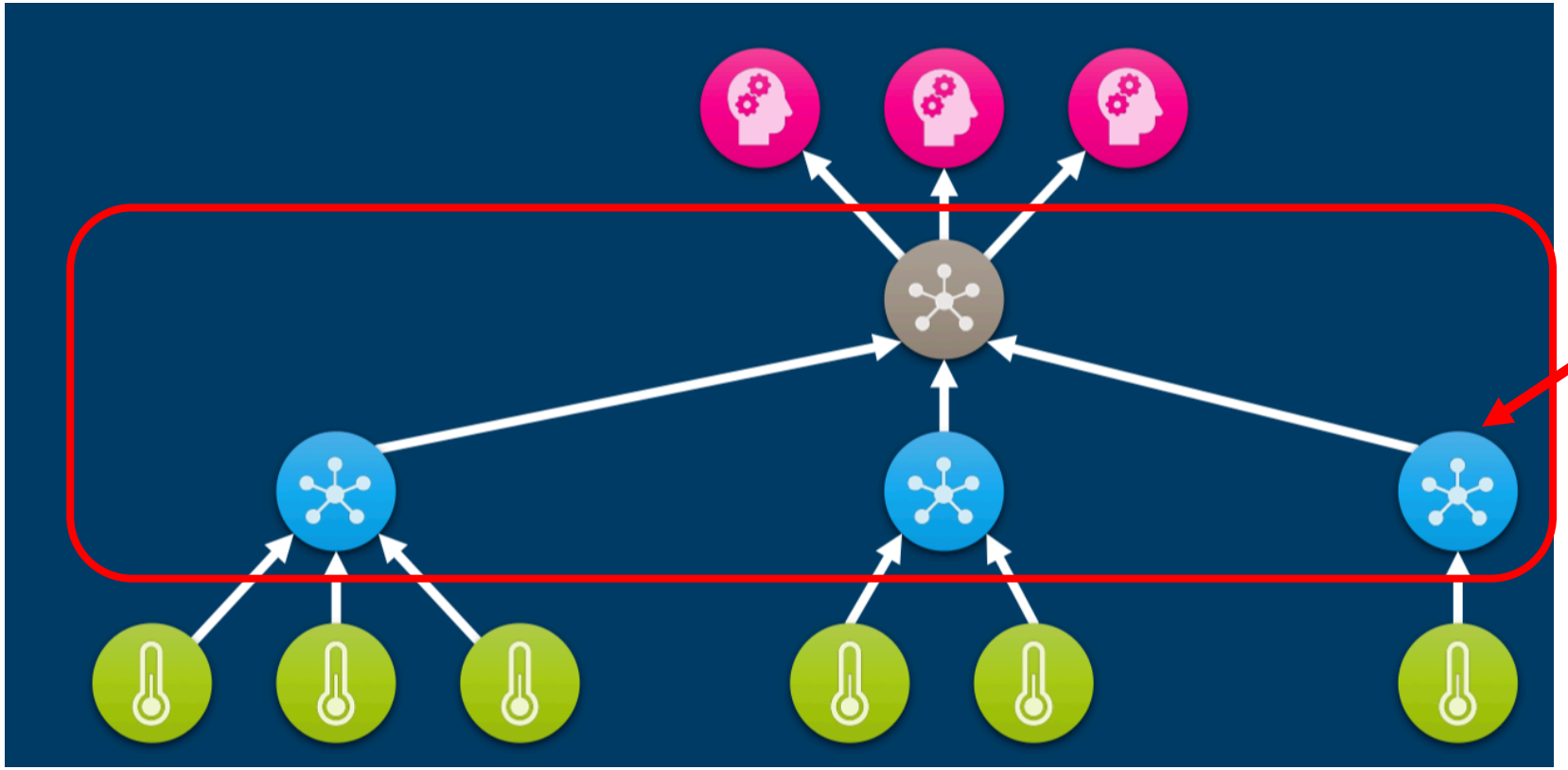
- Location aware
- Geographical distribution
- Mobility
- Large number of nodes
- Low latency

When to Consider Fog Computing

- Data is collected at the extreme edge: vehicles, ships, factory floors, roadways, railways, etc.
- Thousands or millions of things across a large geographic area are generating data.
- It is necessary to analyze and act on the data in less than a second.

--source: cisco

Smartphones?



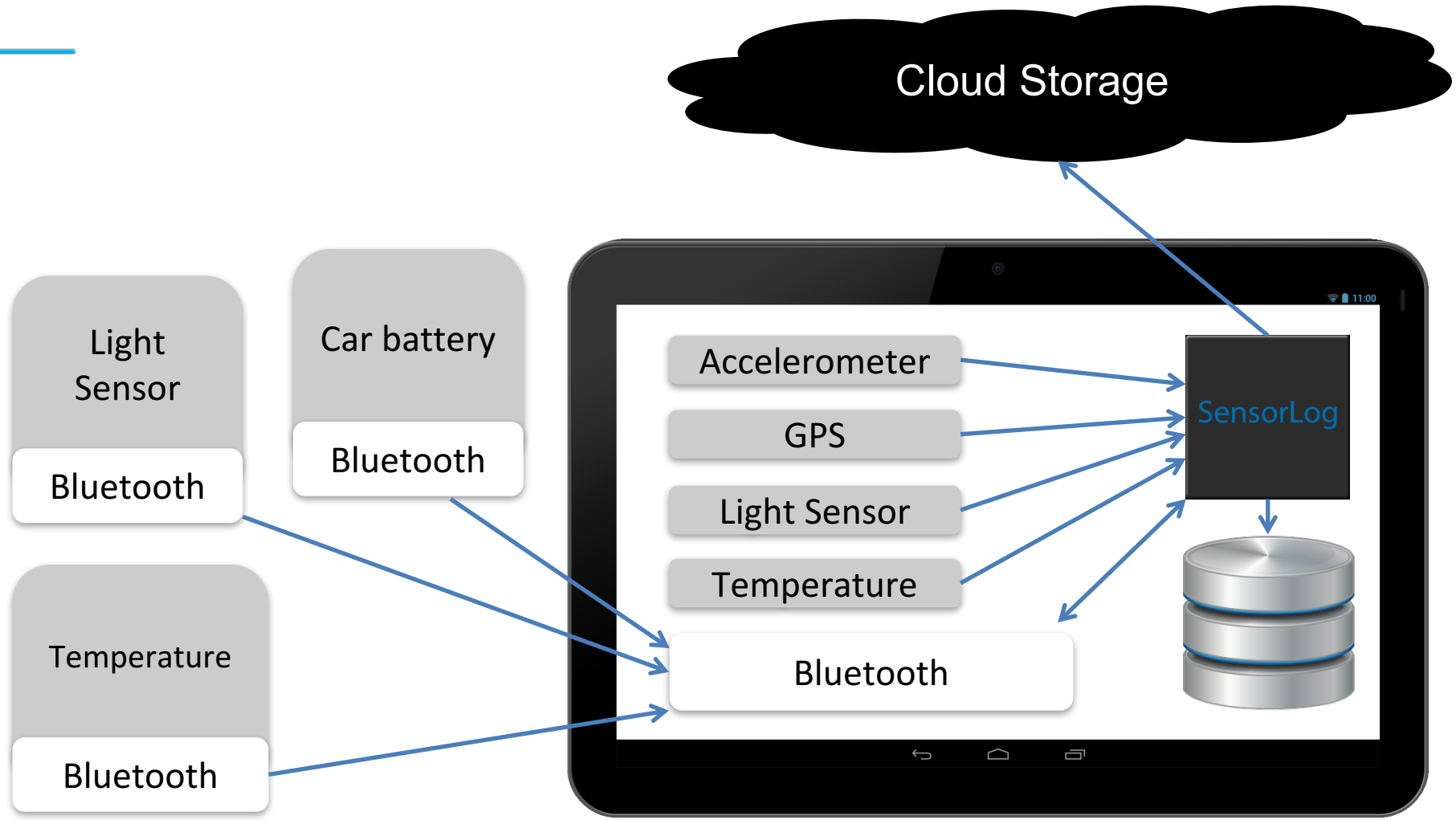
Crowd sourcing: CITI-SENSE

- **FP7 EU project (http://www.citi-sense.eu)**

- **Objective**: Build sensor-based observatory communities for Improving quality of life in cities

- One scenario:
  - Equip people with sensors and use their smartphones as a gateway to upload the measurements in the cloud for analysis
  - Publish observations (their perception of the environment)

Architecture

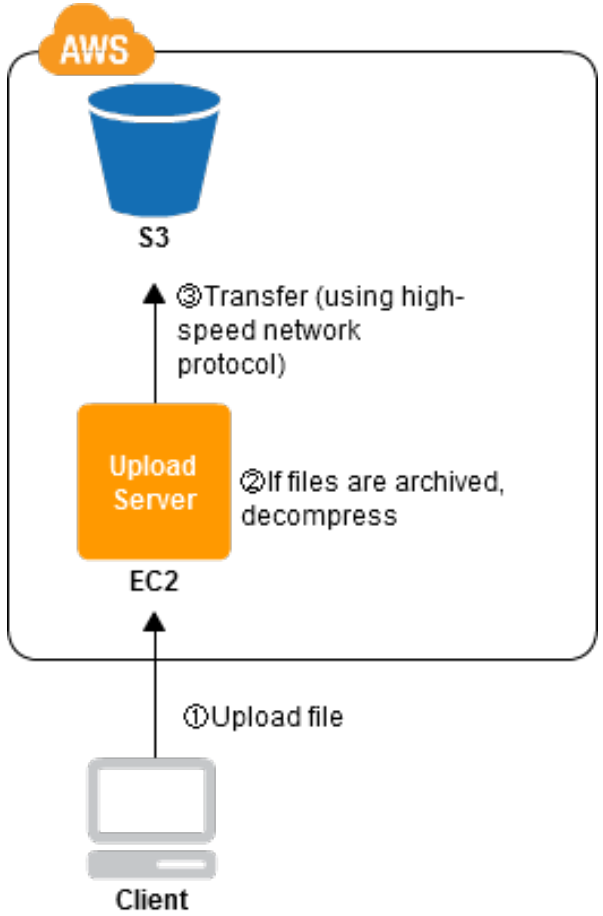


Server side patterns for improving data uploading performances

Write Proxy Pattern

- **Problem:** Some cloud services require the usage of specific protocols (e.g., HTTP as a communication protocol).
  As a result writing speed can be slow

- **Solution:** pass the data to a proxy first.



--source: http://en.clouddesignpattern.org/index.php/CDP:Write_Proxy_Pattern

Patterns for data synchronization and storage

- Storage
  - **Partial storage**
  - Complete storage

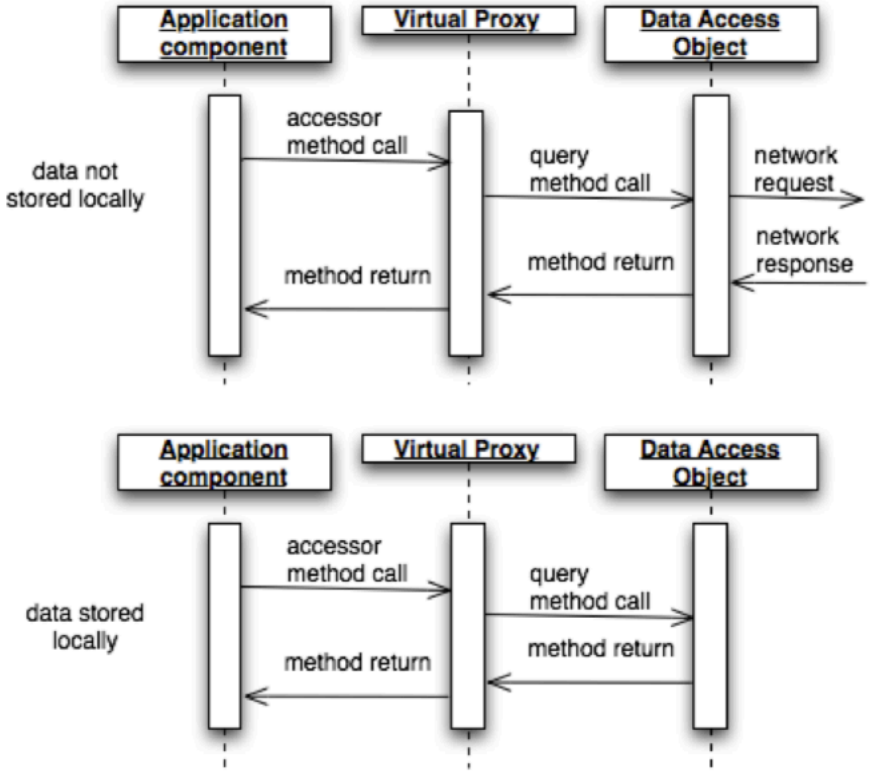
- Synchronization
  - **Asynchronous Data Synchronization**
  - Synchronous Data Synchronization

--source: https://www.dre.vanderbilt.edu/~schmidt/PDF/PatternPaperv11.pdf

Partial Storage

- **Problem:** Network bandwidth and storage space are two vital concerns for mobile application design. Synchronize and store data only as needed to optimize network bandwidth and storage space usage.

- **Solution:** Data is synchronized dynamically "on-demand" by triggers in the application, most typically using a variant of the *Virtual Proxy* pattern.



SINTEF

Asynchronous data synchronization

- **Problem:** Synchronous calls might introduce latency and degrade user experience.
  - What might happen on Android:
    - Android performs a callback,
    - which takes 30s to get a reply,
    - before that Android proposes to kill the app

Since version 3.0 d'Android (API 11), it is forbidden to perform network calls from the main thread.

- **Solution:** Perform asynchronous calls
  - On Android:
    - AsyncTask
    - Runnable

AsyncTask

1. **`onPreExecute:`** Initialisation.
2. **`doInBackground:`** This methods is started in a Thread and is suppose to be the one that actually does the job. In our context: *open the connection, send the request, retrieve the result and close the connection.*
3. **`onProgressUpdate:`** Update about the progress of the job – e.g., to update a progress bar.
4. **`onPostExecute:`** This method is called once the AsynTask is done. In our context: *do something with the result of the request and/or transmit it.*

AsyncTask

- A generic class defined by three generic types, which are Classes! (no -> void, int).

- AsyncTask<Params, Progress, Result>
  - **Params**: Type of parameter of `doInBackground`
  - **Progress**: Type of parameter of `onProgressUpdate`
  - **Result**: Type of parameter of `onPostExecute`

- To be used via sub-classes.

AsyncTask

- To start a task:

```
new myAsyncTask(something).execute(“url1.com”, “url2.com”)
```

- Execute returns void, thus, if the result is not meant to be processed in the `onPostExecute` method, one should use a listener.

Mixing partial storage and asynchronous transfer for uploading high velocity data

- E.g., Smartphone as a gateway that gather data from sensors (internal + external) and upload it on a cloud-based data store.

In background:

1. Manage connections to sensors
2. Retrieve data and store it locally
3. Provide access to recent data
4. On a regular basis upload chunk of data to the cloud
5. If upload successful remove data from local storage

TP

1. **Store Files on AWS S3**
   - Bucket: lecture-epu
   - Cognito id:**eu-west-1:0cab6e17-78a7-4d97-ac68-77b543f21caa**
2. **In parallel store bulks of sensor data on Firebase realtime db**
3. **In parallel store bulks of sensor data on CouchDB:** http://XXX:5984
   1. GPS location, plus others
   2. Feel free to select the sensor you want
4. **Add markers on Google Map**
   - Activate Android Map

AWS S3

- **Concepts**: Store files in Buckets deployed in a specific region
- Manifest.xml

```
<service android:name="com.amazonaws.mobileconnectors.s3.
transferutility.TransferService” android:enabled="true" />
```

- Create S3 client & Transfer tool

```
AmazonS3 s3 = new AmazonS3Client(credentialsProvider);

TransferUtility transferUtility = new TransferUtility(s3, APPLICATION_CONTEXT);
```

- Upload/download

```
TransferObserver observer = transferUtility.upload(

  MY_BUCKET,     /* The bucket to upload to */

  OBJECT_KEY,    /* The key for the uploaded object */

  MY_FILE        /* The file where the data to upload exists */

);
```

AWS S3

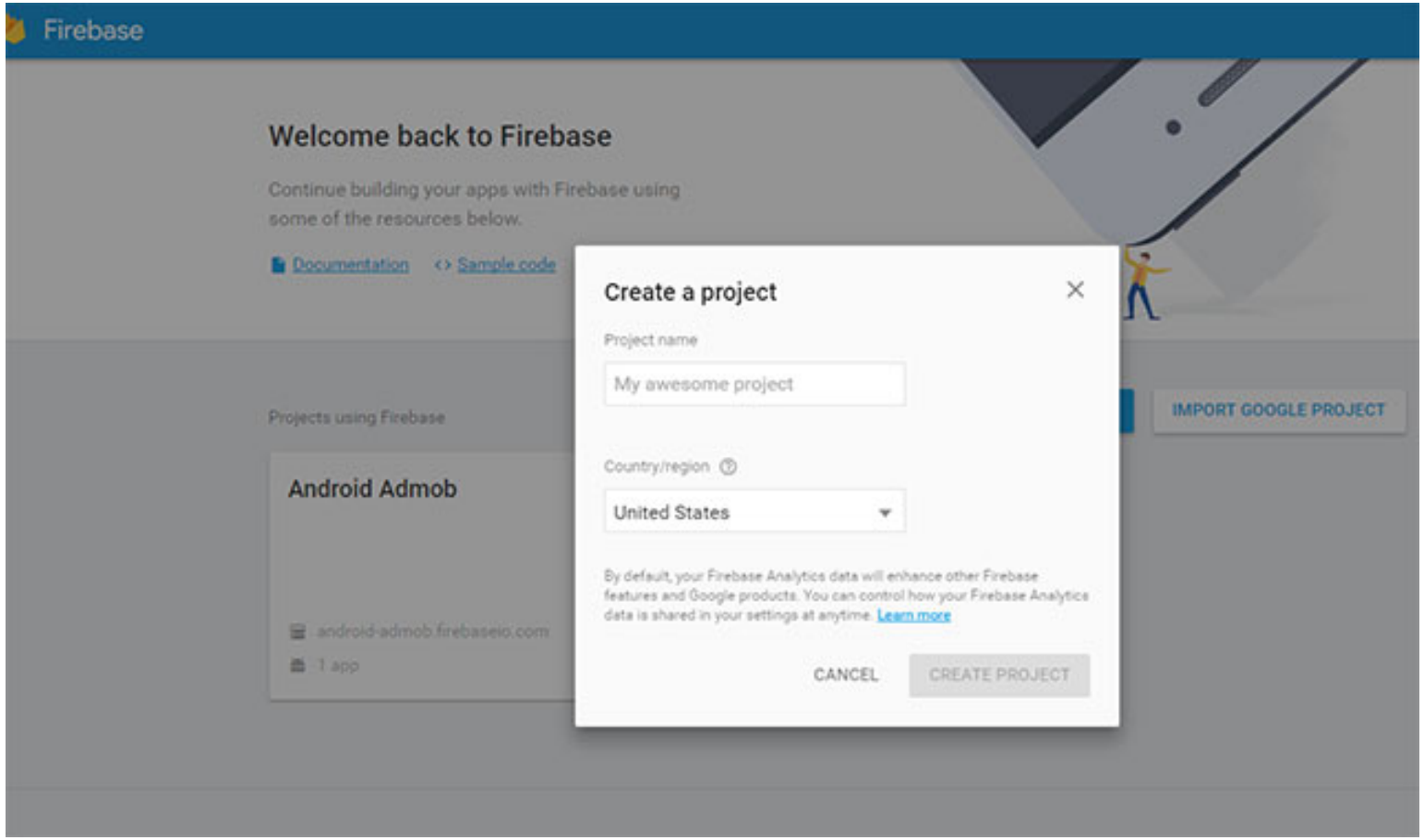
- Check status of Download/Upload

```
transferObserv
    @Override
    public voi
        // do
    }
    @Override
    public voi
        int pe
        //Disp
    }
    @Override
    public void onError(int id, Exception ex) {
        // do something
    }
});
```

More details on:

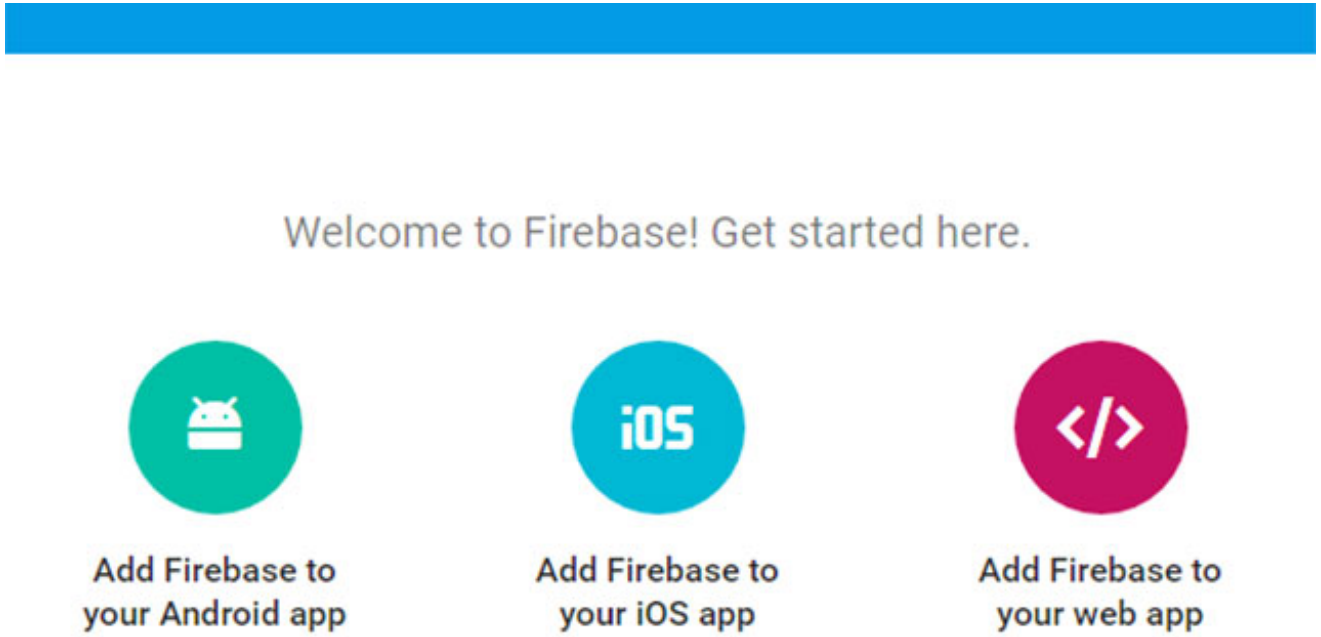
http://docs.aws.amazon.com/mobile/sdkforandroid/developerguide/s3transferutility.html

Firebase



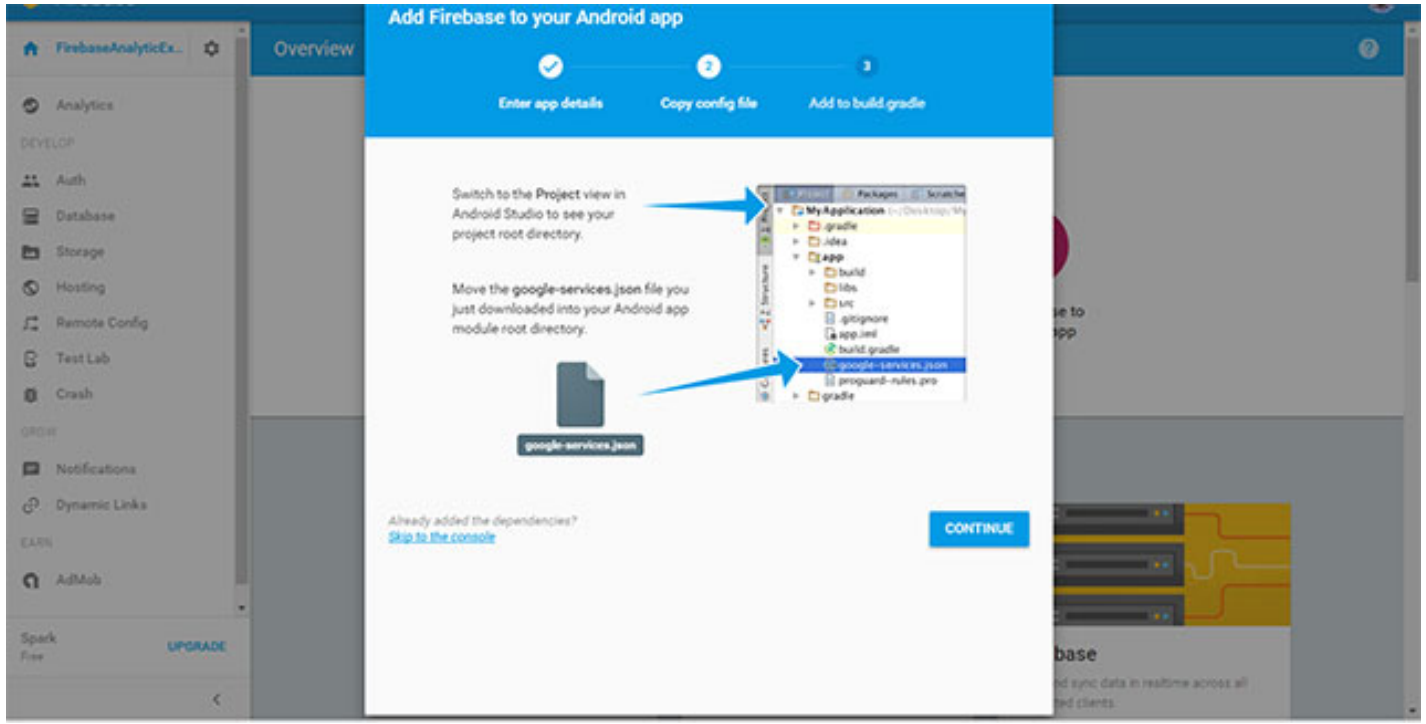
SINTEF

Firebase



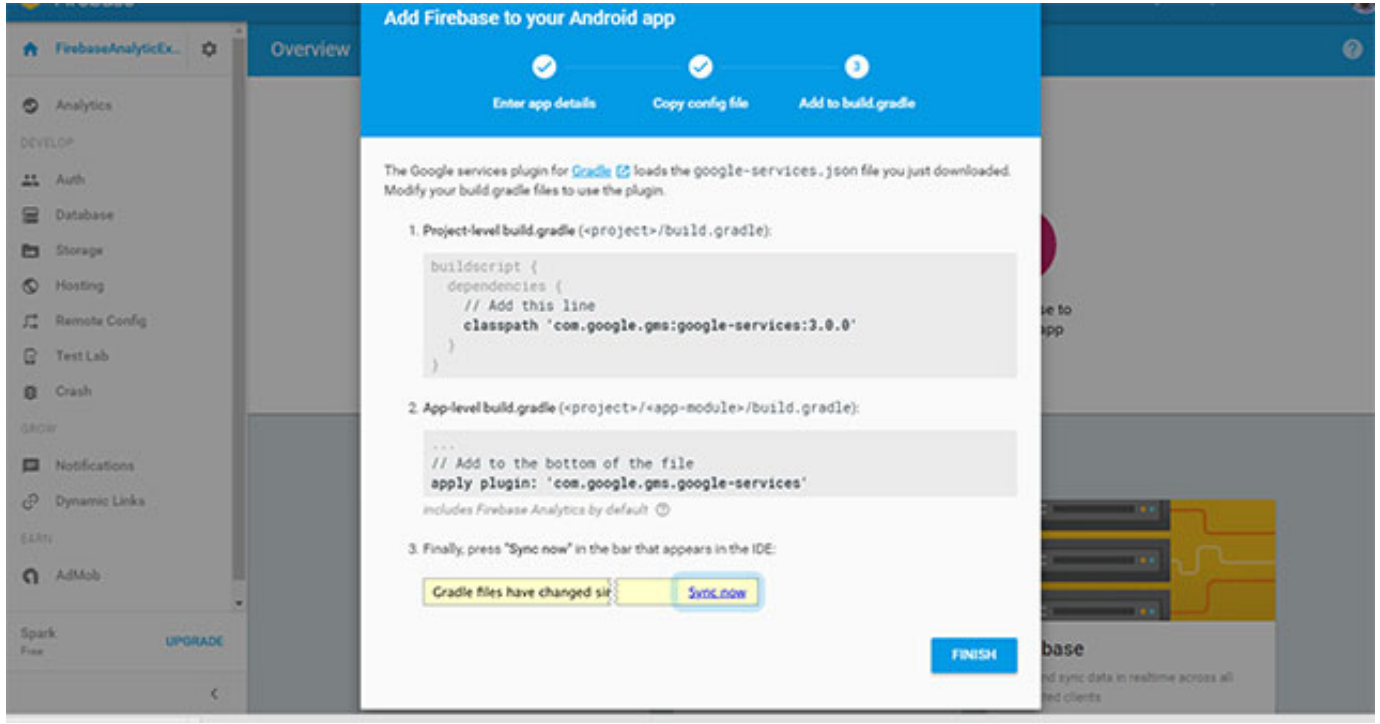
SINTEF

Firebase



SINTEF

Firebase



SINTEF

Firebase

https://firebase.google.com/docs/database

Google map

- Manifest.xml

```
<uses-feature
  android:glEsVersion="0x00020000"
  android:required="true"
  />

<meta-data
    android:name="com.google.android.maps.v2.API_KEY"
    android:value="AIzaSyDajV01lxlQeTCchInMYpvtnIBoGOf8iFM"
    />
<meta-data
    android:name="com.google.android.gms.version"
    android:value="@integer/google_play_services_version"
    />
```

- Get SHA1
  - Mac OS/Linux
    - keytool -list -v -keystore ~/.android/debug.keystore -alias androiddebugkey -storepass android -keypass android
  - Windows
    - keytool -list -v -keystore "%USERPROFILE%\.android\debug.keystore" -alias androiddebugkey -storepass android -keypass android