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May 17, 2024

Geodetic Engineering Study Program

Dept. of Geodetic Engineering, UGM

Pengenalan Basisdata NoSQL dan Query JSON pada PostgreSQL

(TKD211207)

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Basisdata NoSQL & JSON Query

- Jenis-jenis basisdata NoSQL
- Perbedaan basisdata SQL dan NoSQL
- Dokumen JSON
- Query dokumen JSON pada PostgreSQL

Komponen Penilaian

CPMK1	Menjelaskan konsep basisdata dan karakteristik basisdata serta bagaimana pengelolaan basisdata dengan memperhatikan keunggulan dan kelemahan sistem basisdata
CPMK2	Melakukan pemodelan data relasional dan penyusunan tabel-tabel basisdata
CPMK3	Melakukan pemodelan data dan implementasinya dengan pendekatan “bottom-up” (identitas dan determinan atribut tabel) dan proses normalisasi (1st, 2nd, 3rd, Boyce-Codd Normalisation)
CPMK4	Pemodelan data dengan diagram E-R (pendekatan “top-down”), tahapan logikal dan tahapan fisikal dalam bentuk tabel-tabel normal.
CPMK5	Melakukan pertanyaan (query) basisdata dengan relasi aljabar tabel dan SQL (Structured Query Language)

Komponen Penilaian

Komponen Penilaian	%	CPMK					Media
		1	2	3	4	5	
Kuis I – Desain Basisdata	15	√					Kuis-Elok (MCQ)
Laporan Desain Basidata (Diagram Konseptual)	15		√	√			Assignment-Elok
Laporan PostgreSQL	15		√	√	√		Assignment-Elok
Kuis II - Query SQL	20			√	√		Kuis Elok (Essay)
Proyek Akhir Rancangan Basisdata	35			√	√	√	ELOK/Simaster

Materi Praktikum

Minggu 1 - Pengantar Praktikum Sistem Basisdata

Minggu 2 - Konsep Dasar Tabel dan Desain Basisdata

Minggu 3 - Normalisasi Tabel

Minggu 4 - Pemodelan Data dan Pembuatan Tabel Entiti

Minggu 5 - Diagram ER dan UML

Minggu 6 - Menyusun Basisdata Relasional

Minggu 7 - Operasi Relasi Aljabar

Minggu 8 - Bahasa SQL Relasional

Minggu 9 - Membuat basisdata dengan PostgreSQL

Minggu 10 - Manajemen basisdata dengan PostgreSQL

Minggu 11 - Query Basisdata: DDL, DML, DCL dan TCL

Minggu 12 - Query Basisdata Lanjut

Minggu 13 - Pengenalan Basisdata NoSQL

Minggu 14 – Proyek Akhir

"DATA IS THE NEW OIL."

Coined in 2006 by Clive Humby, a British data commercialization entrepreneur, this now famous phrase was embraced by the World Economic Forum in a 2011 report, which considered data to be an economic asset, like oil.

From the beginning of recorded time until 2003, we created **5 exabytes** (5 billion gigabytes) **of data.**

In 2011 the same amount was created every two days.

By 2013, it's expected that the time will shrink to 10 minutes.

There are nearly as many bits of information in the digital universe as there are stars in our actual universe.

There are **133 million BLOGS** on the web.

As of August 2012, there were just over **4 million** articles in the English Wikipedia.

80% of all humans own a mobile phone of some sort. Out of 5 billion mobiles, 1 billion are smartphones. (In Singapore, 34% of citizens are smartphone users.)

English is the dominant language of the web. But by 2014 it will be **Chinese,** if its current rate of increase continues.

Top languages used on the web (May 2011):

247 billion EMAILS are sent every day. (Up to 80% are spam.)

Every hour, we create enough Internet traffic to fill **7 billion DVDs.** Side by side, that's [illegible] seven times the height of Everest.

Just as a study of activity on Twitter gave residents, family members, and journalists advance warning of details about the devastating earthquake and tsunami in Japan, **high-frequency traders,** with the help of computer algorithms, use Big Data to follow trends and to act quickly on their findings.

These specialized algorithms make split-second decisions to buy or sell a commodity. New cable being laid under the Atlantic will shave **5 milliseconds** from the current 65 milliseconds it takes for trading instructions to travel between New York City and London.

With new fiber-optic cable, the round-trip time between New York and London will be 59.6 milliseconds.

This 5-millisecond saving is worth many millions of dollars to the trading firms who use the cable (and who will pay millions to do so).

How they save 5 milliseconds

The depth of the Atlantic Ocean varies.

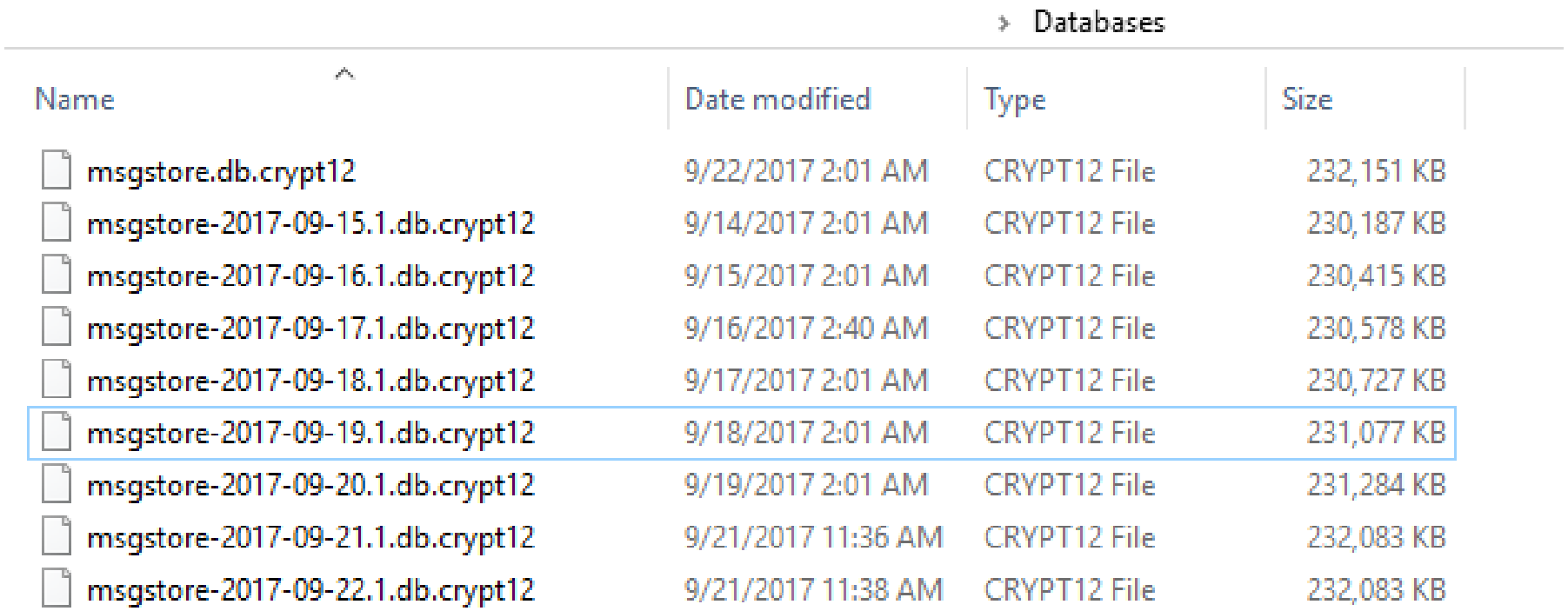
The new cable will lie on areas of the ocean floor that are up to 1,000 feet shallower than the current fastest cable. By taking a different route, the new cable is shorter, meaning that the time it takes for messages to travel along it is shortened.

60% of all humans (5.4 billion people) are active texters. In 2010, 193,000 text messages were sent every second.

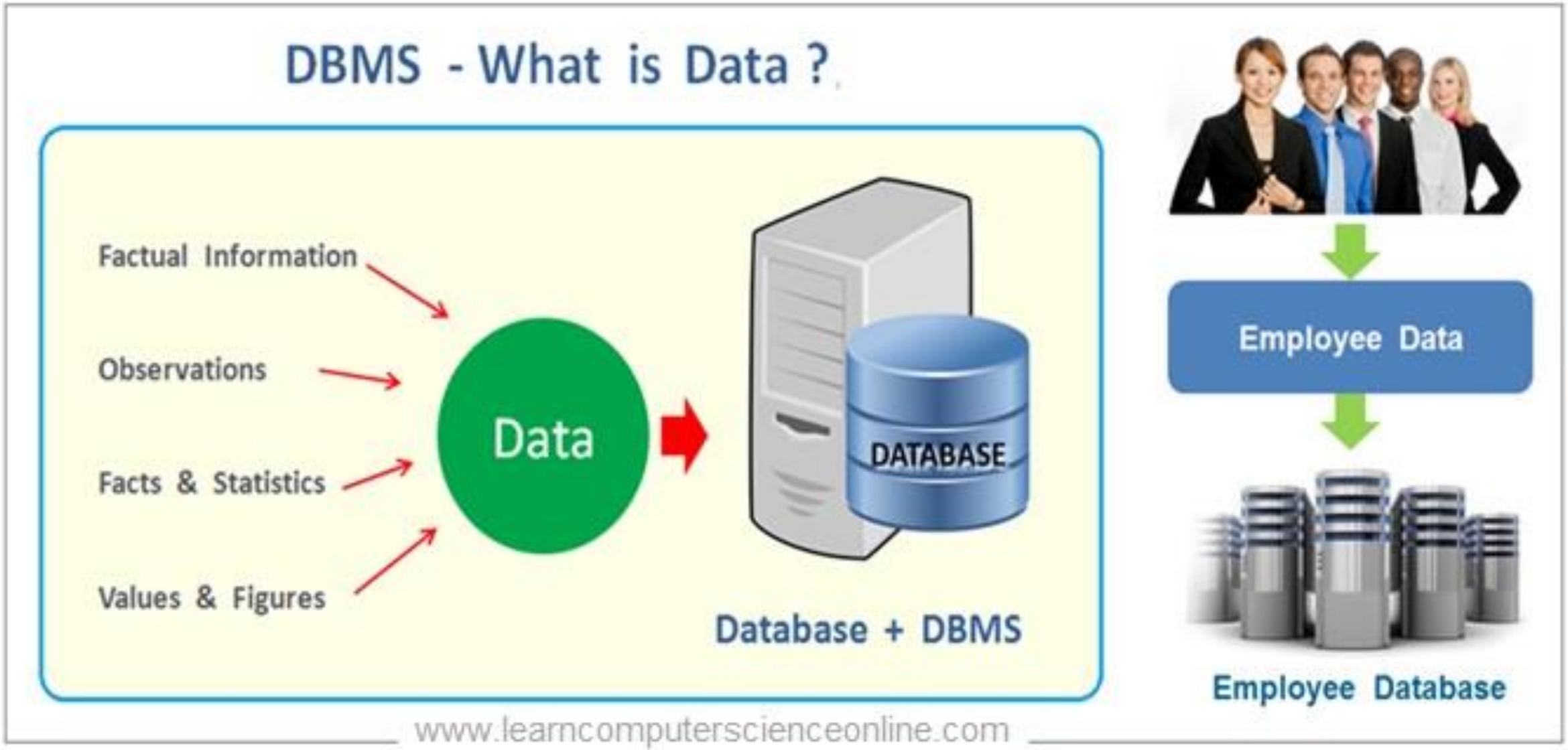
10% of all photos ever taken were taken in 2011.

50% of 5-year-old kids in the U.S. are given access to a smartphone.

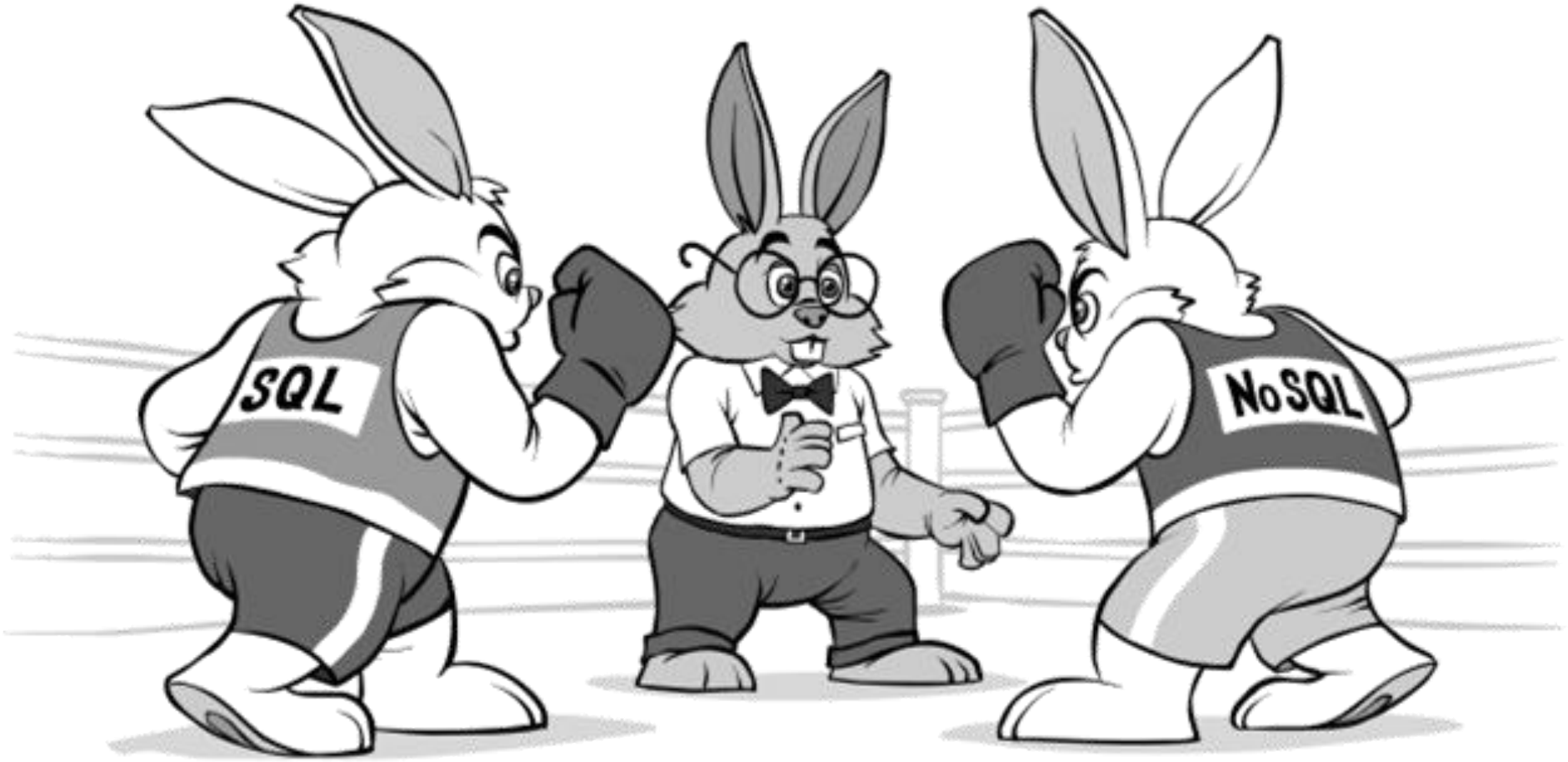
Database:
a Systematic Collection of DATA



DBMS - Database Management System - What Is Data ?



SQL vs NoSQL



Contoh Basisdata **Relasional (SQL)**

Basisdata **Relasional (SQL)**

- Seluruh Skema harus **didesain dari awal** melalui perancangan basisdata
- Skema dan model fisik yang dihasilkan bersifat **rigid (kaku).** Begitu model fisik dibuat, perubahan pada kolom harus merubah seluruh struktur basisdata
- Sangat sesuai untuk kasus dimana **struktur data tidak banyak berubah** serta memerlukan validasi transaksi yang pasti (seperti: transaksi keuangan di bank)

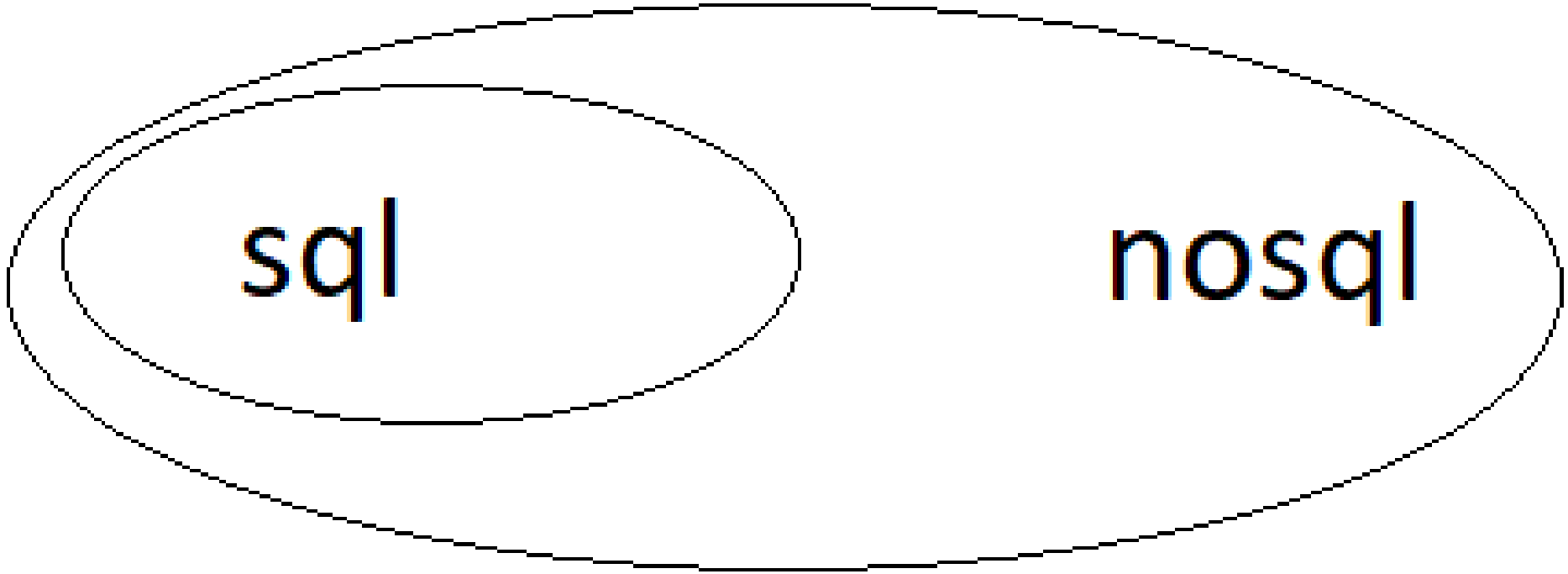
Basisdata **Relasional (SQL)**

What if:

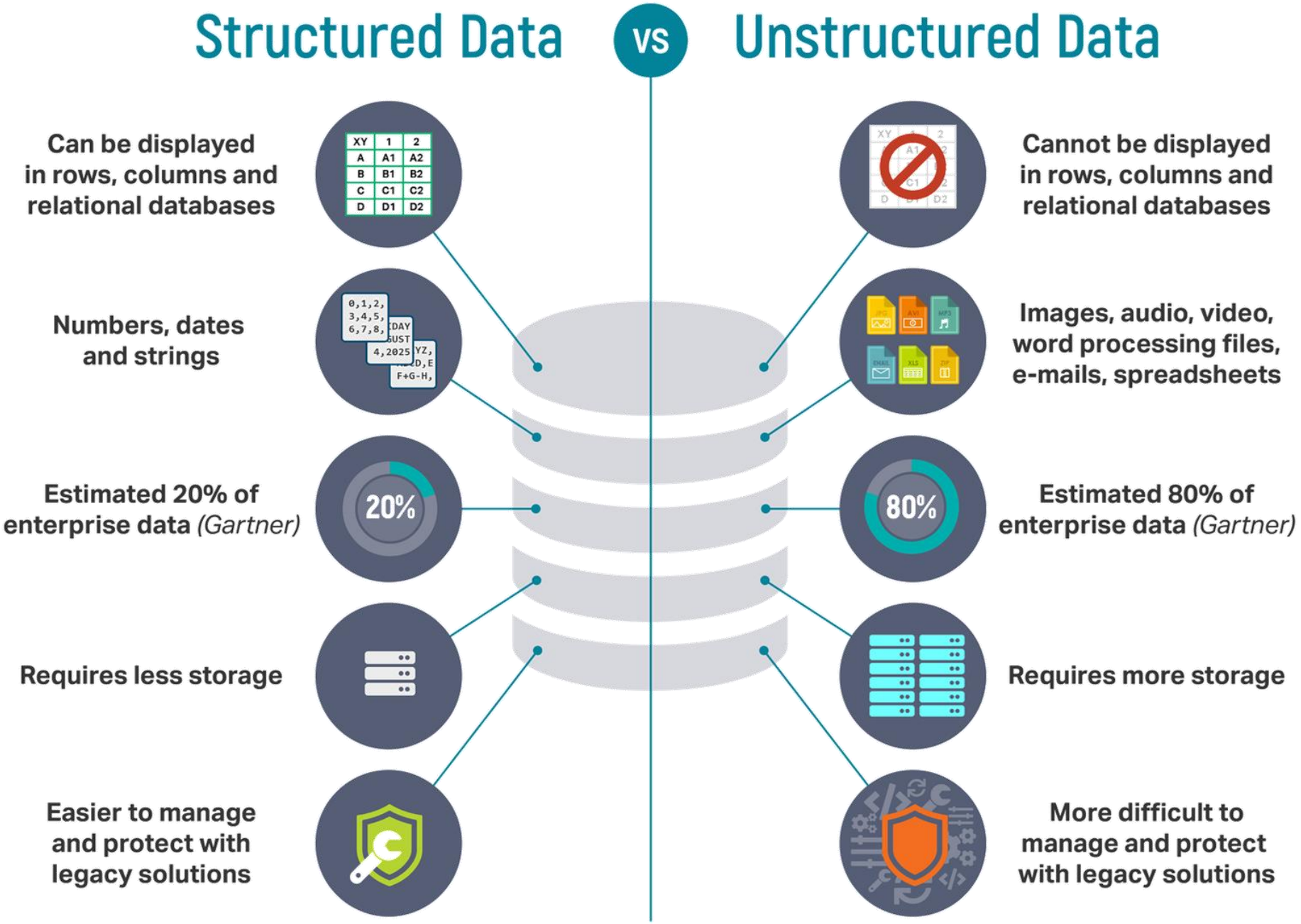
Tabel Karyawan:

Nama | Alamat | No HP

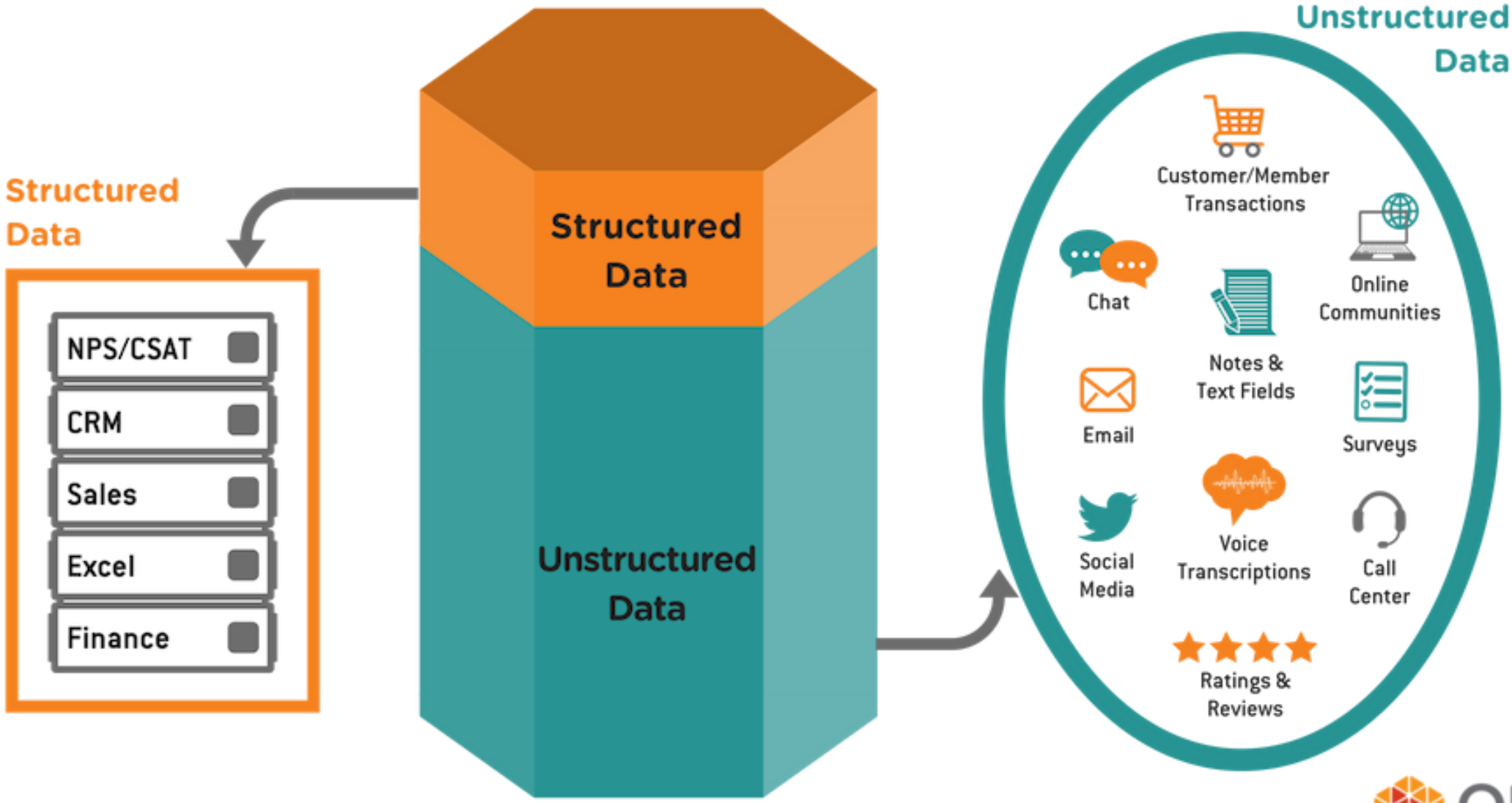
Jika seorang karyawan memiliki lebih dari satu no hp, apa yang harus dilakukan?



NoSQL: “Not Only SQL”


Structured Data
vs
Unstructured Data
Can be displayed in rows, columns and relational databases
Numbers, dates and strings
Estimated 20% of enterprise data (Gartner)
Requires less storage
Easier to manage and protect with legacy solutions
Cannot be displayed in rows, columns and relational databases
Images, audio, video, word processing files, e-mails, spreadsheets
Estimated 80% of enterprise data (Gartner)
Requires more storage
More difficult to manage and protect with legacy solutions
20%
80%

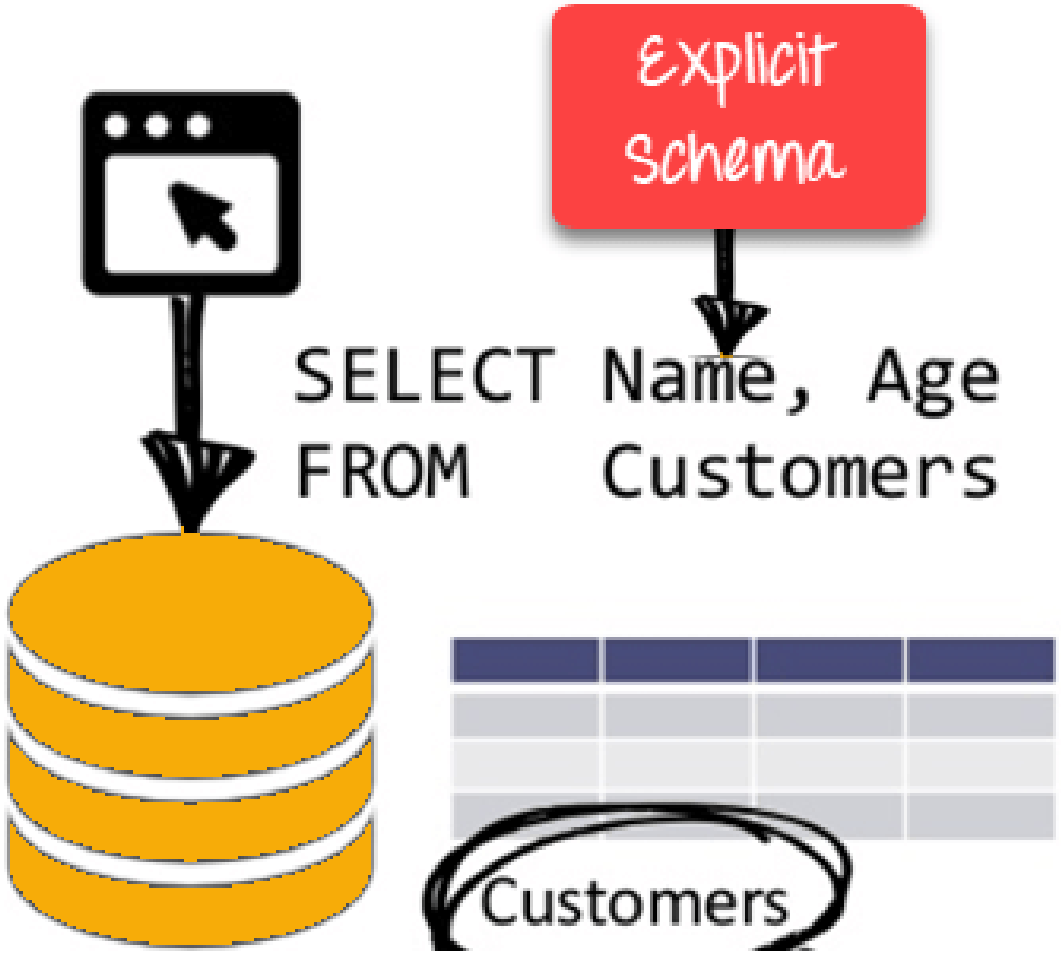
What's Hiding in Your Unstructured Data?



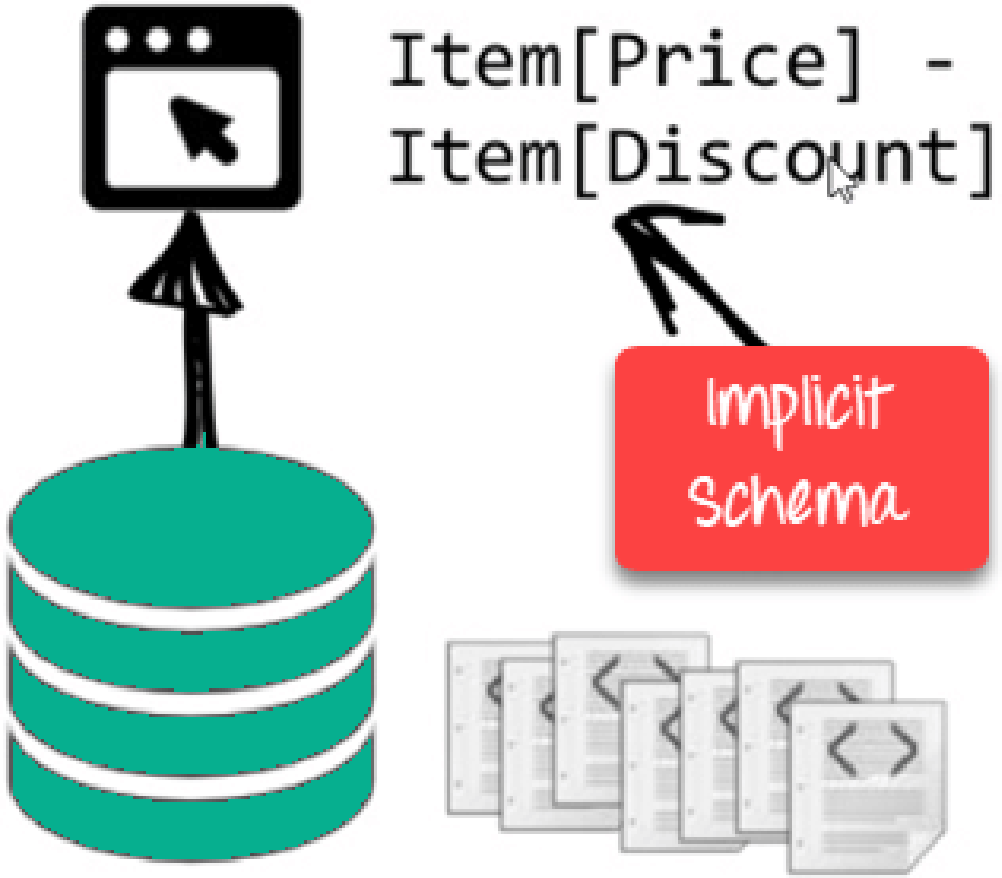
Source: Graphic adapted from January 2018 CXPA Presentation "The Why Behind the What," Jim Kitterman

ORI
Innovative Insights. Driving Results.

RDBMS:



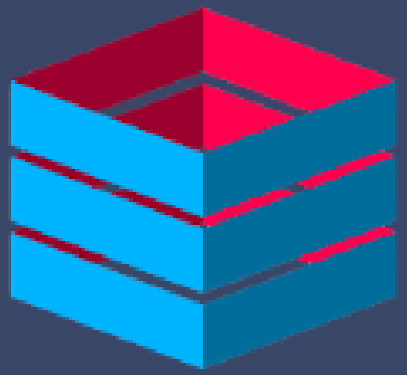
NoSQL DB:



What is NoSQL Database

High Scalability

High Availability



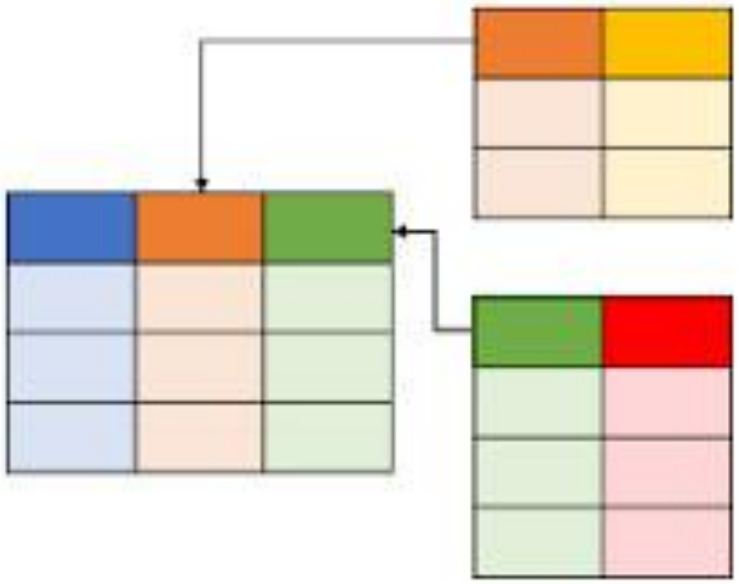
NoSQL Database

Big Data Capability

Fast Performance

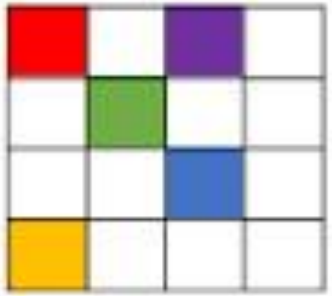
Easy Replication

SQL DATABASES

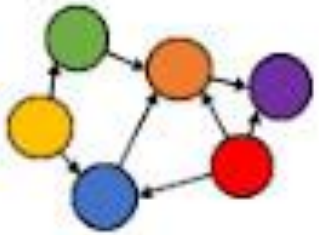


Relational

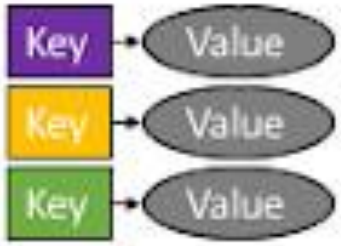
NoSQL DATABASES



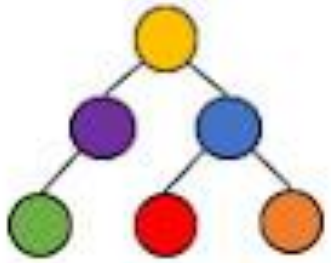
Column



Graph



Key-Value



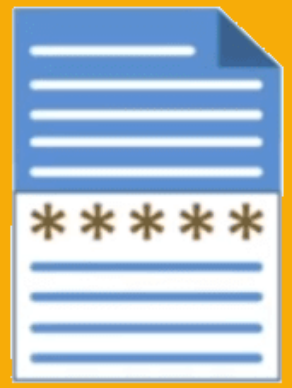
Document

Jenis-jenis Basisdata NoSQL

Key Value

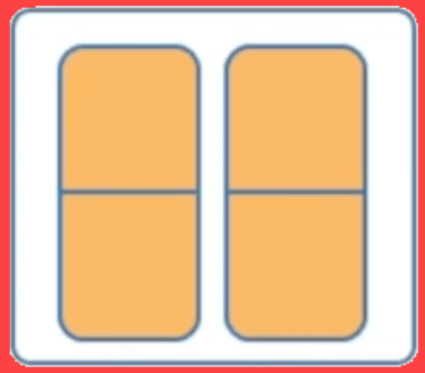
Example:
Riak, Tokyo Cabinet, Redis server, Memcached, Scalaris

Document-Based



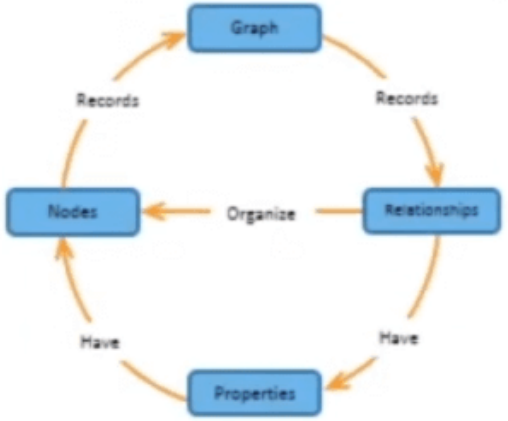
Example:
MongoDB, CouchDB, OrientDB, RavenDB

Column-Based



Example:
BigTable, Cassandra, Hbase, Hypertable

Graph-Based



Example:
Neo4J, InfoGrid, Infinite Graph, Flock DB

SQL vs NoSQL (document-based)

Col1	Col2	Col3	Col4
Data	Data	Data	Data
Data	Data	Data	Data
Data	Data	Data	Data

Document 1

```
{
  "prop1": data,
  "prop2": data,
  "prop3": data,
  "prop4": data
}
```

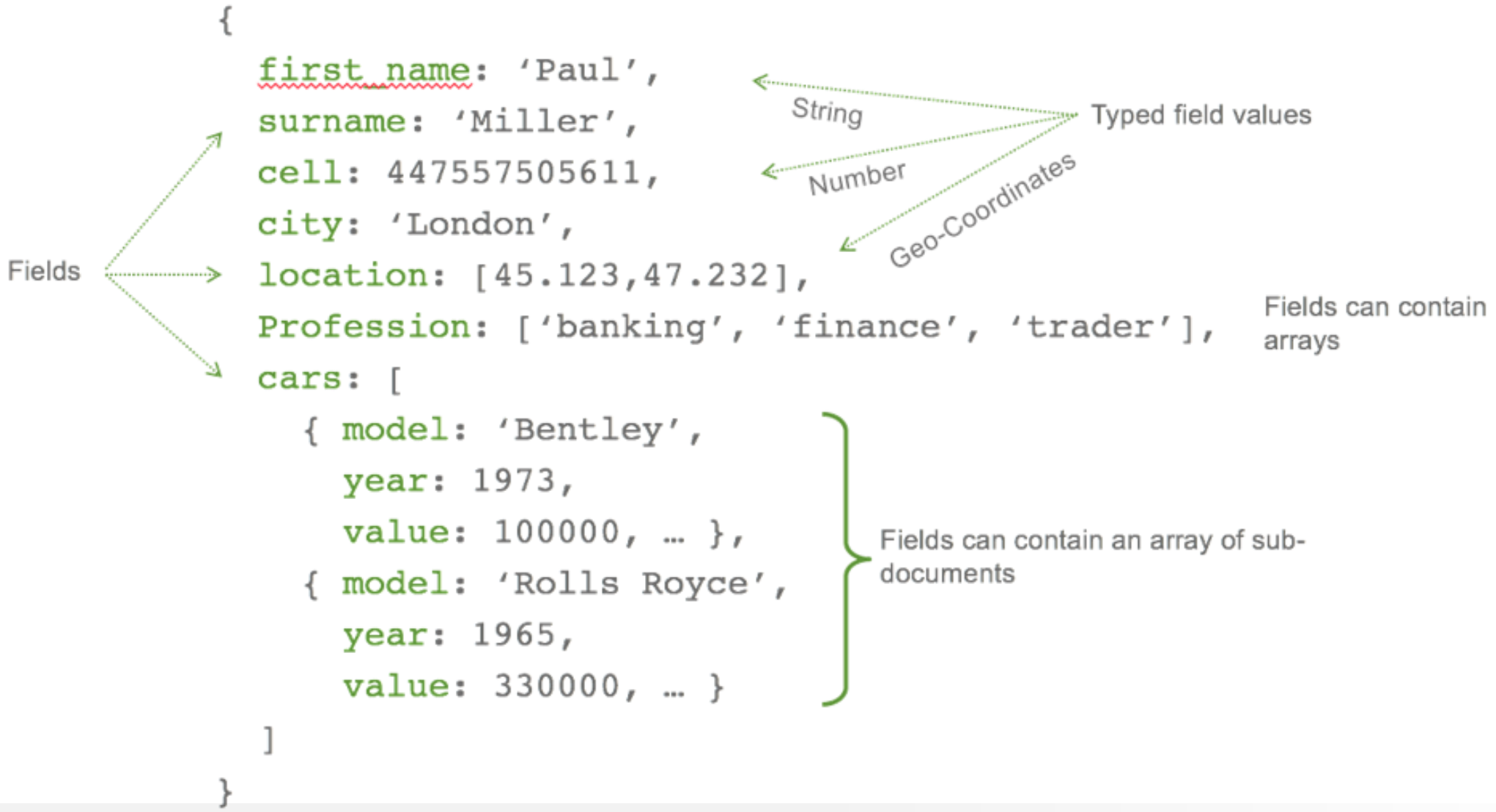
Document 2

```
{
  "prop1": data,
  "prop2": data,
  "prop3": data,
  "prop4": data
}
```

Document 3

```
{
  "prop1": data,
  "prop2": data,
  "prop3": data,
  "prop4": data
}
```

Contoh Basisdata NoSQL: Document Based (JSON)



Contoh Basisdata NoSQL: Document Based (JSON)

Find all contacts with at least one work phone or hired after 2014-02-02

SQL

```
select A.did, A.lname, A.hiredate, B.type,
B.number from contact A left outer join phones B
on (B.did = A.did) where b.type = 'work' or
A.hiredate > '2014-02-02'::date
```

MongoDB CLI

```
db.contacts.find({"$or": [
{"phones.type":"work"},
{"hiredate": {"$gt": new ISODate("2014-02-02")}}
]});
```

mongoDB®

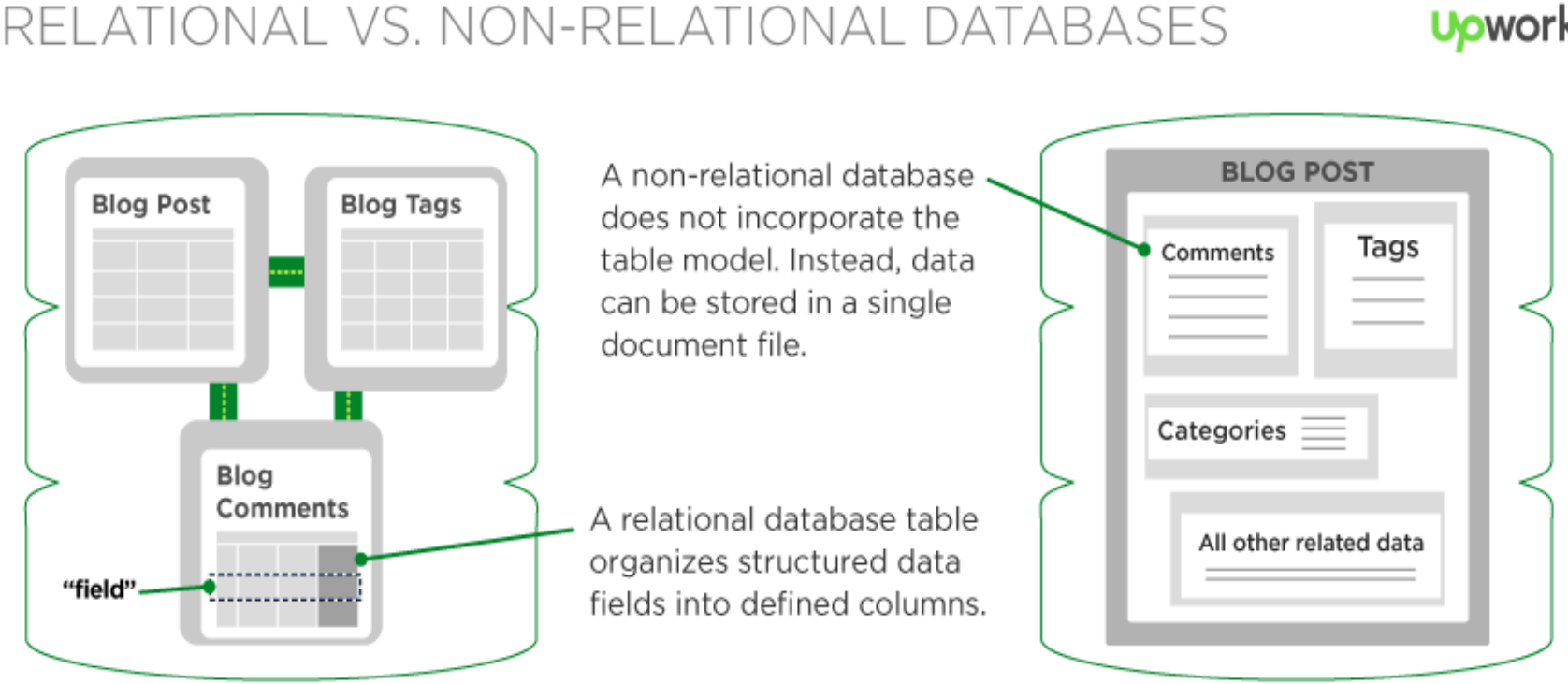
Mengapa perlu belajar NoSQL?

> *Exponentially growing number of unstructured geospatial data (e.g. Instagram Posts)*

1. RDBMS is a well-known solution for storing **spatial data** on the web.

2. No-SQL is a new database paradigm designed for storing large, unstructured data, especially for the web

3. How do we know when to **choose SQL or NoSQL** for our use cases?



Alternatif Solusi: Kolom JSONB pada PostgreSQL

PostgreSQL juga dapat menyimpan kolom dalam format JSON

Akibatnya, query bisa lebih fleksibel, sama seperti yang terjadi pada basisdata NoSQL

```
insert into customers (name, contacts) values (
  'Jimi',
  '[
    {"type": "phone", "value": "+1-202-555-0105"},
    {"type": "email", "value": "jimi@gmail.com"}
  ]'
);

insert into customers (name, contacts) values (
  'Janis',
  '[
    {"type": "email", "value": "janis@gmail.com"}
  ]'
);
```

Alternatif Solusi: Kolom JSONB pada PostgreSQL

PostgreSQL juga dapat menyimpan kolom dalam format JSON

Akibatnya, query bisa lebih fleksibel, sama seperti yang terjadi pada basisdata NoSQL

```
1  select
2      id,
3      i18n_name,
4      i18n_name->'en' as en
5  from property_keys;
```

Data Output | Explain | Messages | Notifications | Query History

	id bigint	i18n_name jsonb	en jsonb
1	1	{"en":"a","de":"a","ru":"a"}	[null]
2	2	{"en":"asdasdadad","de":"asdasdadad","ru":"asdasdadad"}	[null]

Tugas Akhir Praktikum SBD

https://gdugm.link/project-akhir-sbd

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TERIMA KASIH

LOCALLY ROOTED, GLOBALLY RESPECTED