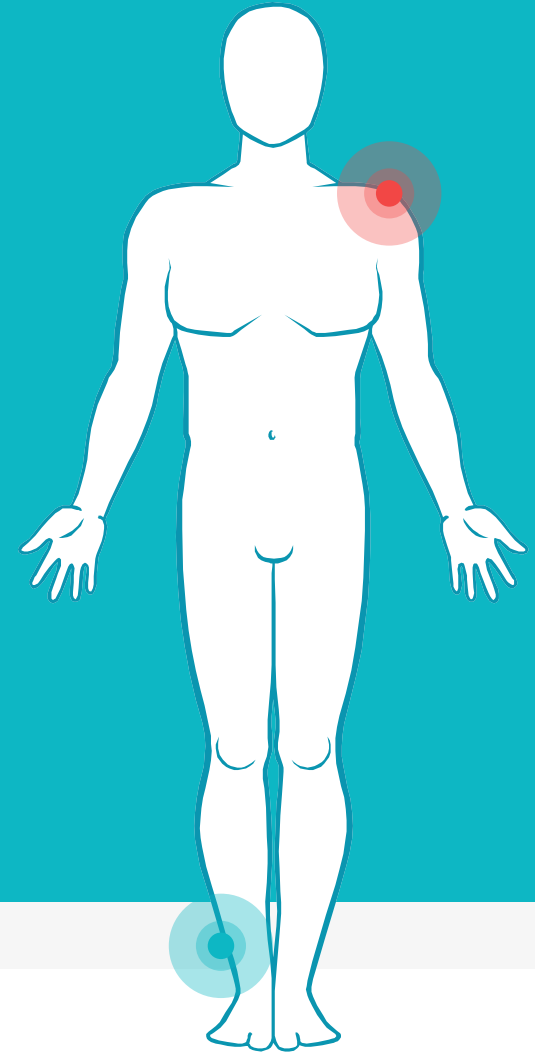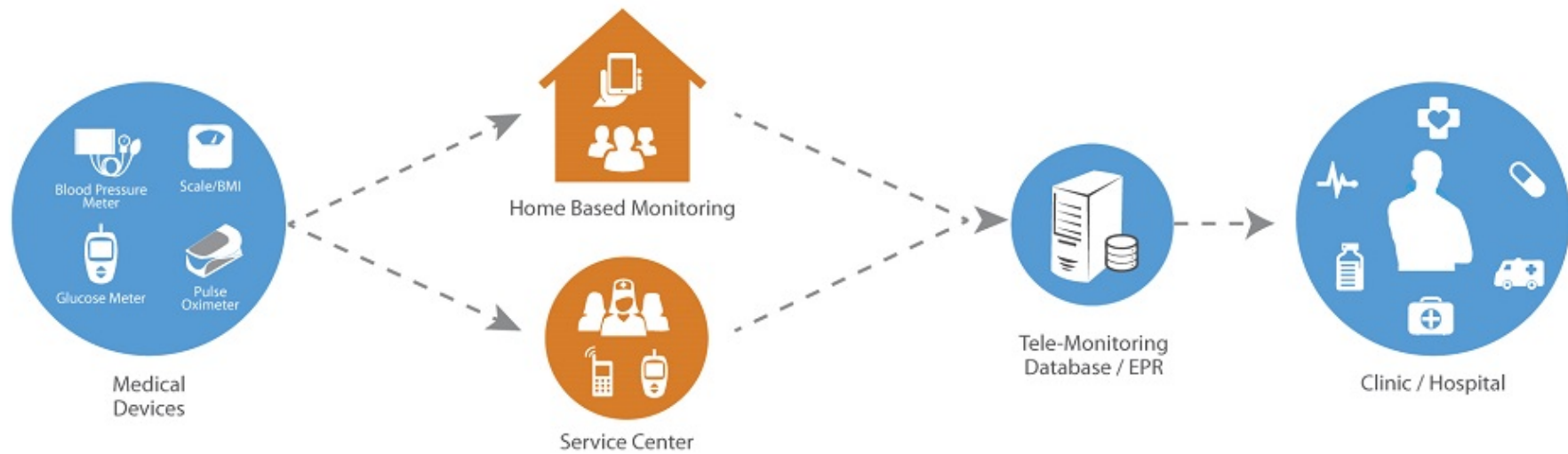# REMOTE PATIENT MONITORING SERVICE

Andrea Canepa, Stefano Rebora – ADM project 2017/18

REMOTE PATIENT MONITORING (RPM)

▷ Technology to enable monitoring of patients outside of conventional clinical settings

▷ Based on IoT

▷ Data-intensive application

AIM OF THE PROJECT

The goal of the project is the design and the development of the large-scale data management/data processing layer

PART I

▷ Provide application and system requirements (~10h)

▷ Choice of the reference technology

PART II

▷ Schema and workload definition (~15h)

▷ Cluster and dataset creation (~10h)

▷ Schema and workload implementation (~10h)

CASSANDRA AS REFERENCE TECHNOLOGY

Why?

Practical reasons
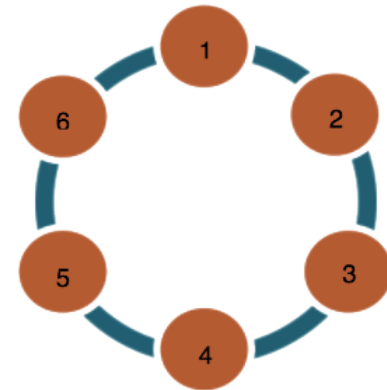▷ We have studied Cassandra during the course and labs

Conceptual reasons
▷ The aim of our application is to collect patient data instead of carrying out periodical regular analyses
▷ No need of real time monitoring and real time streaming of data

CLUSTER SETUP AND CCM

▷ Configuration development and cluster test using Cassandra Cluster Manager (**CCM**)

▷ Replication factor of three and 'SimpleStrategy' replication strategy

▷ Cassandra ring topology (six nodes, one rack)

▷ Distributed Hash Partitioning

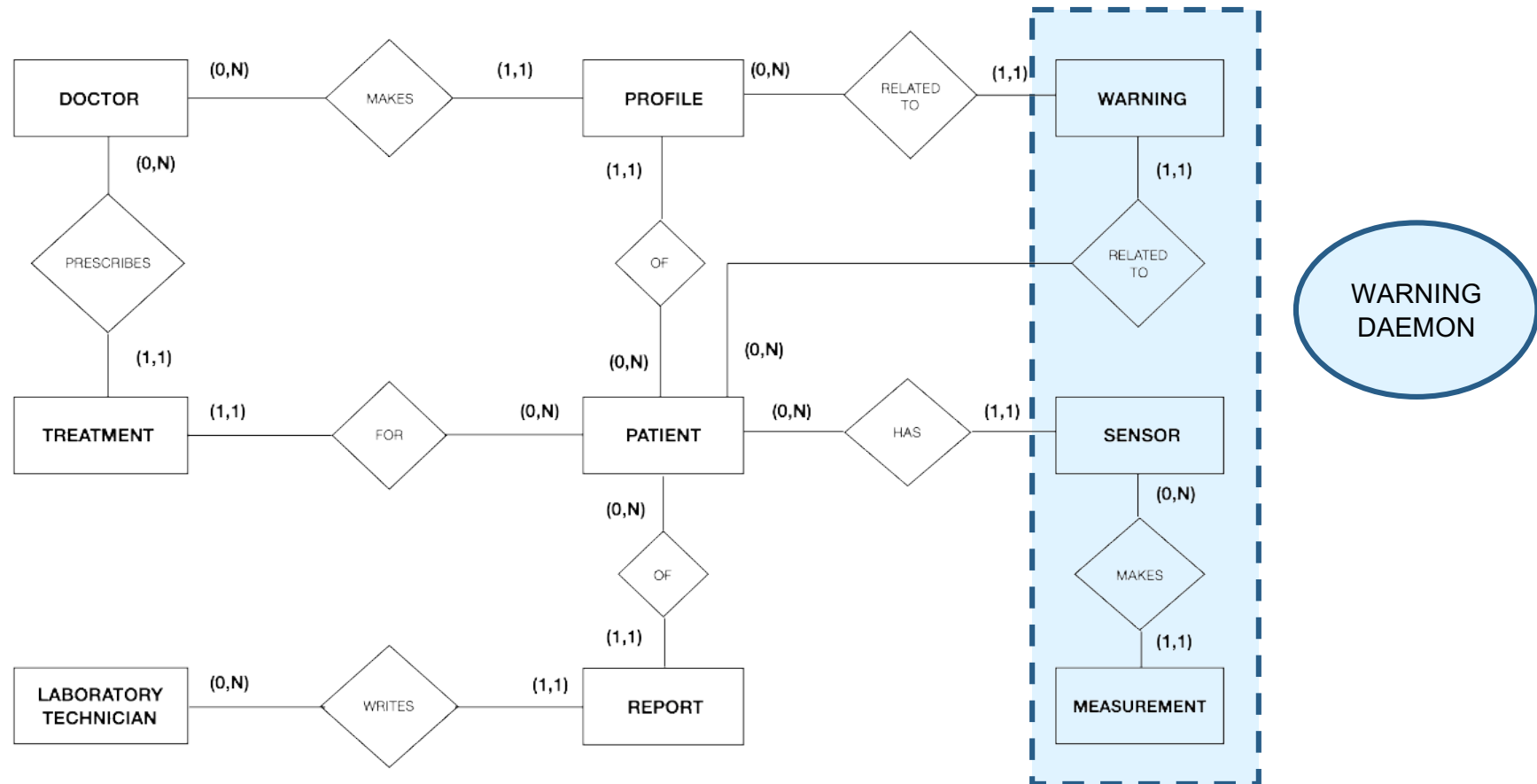▷ Each node has the 50% of the data

CCM: COMMANDS

Easy start
- ▷ ccm create cluster_name –v 3.11.1
- ▷ ccm populate –n 6
- ▷ ccm start

Utilities
- ▷ ccm status
- ▷ ccm node1 ring

```
Datacenter: datacenter1
==========
Address      Rack       Status State    Load         Owns      Token
                                                                6148914691236517202
127.0.0.1    rack1      Up     Normal   171.66 KiB   50.00%    -9223372036854775808
127.0.0.2    rack1      Up     Normal   155.57 KiB   50.00%    -6148914691236517206
127.0.0.3    rack1      Up     Normal   160.07 KiB   50.00%    -3074457345618258604
127.0.0.4    rack1      Up     Normal   163 KiB      50.00%    -2
127.0.0.5    rack1      Up     Normal   165.6 KiB    50.00%    3074457345618258600
127.0.0.6    rack1      Up     Normal   173.23 KiB   50.00%    6148914691236517202
```

CONCEPTUAL SCHEMA

WORKLOAD AND CQL

Cassandra's tunable consistency for client requests

▷ CONSISTENCY LOCAL_QUORUM for strong consistency
▷ CONSISTENCY ONE for operations where consistency requirements are not stringent

Cassandra Query Language (CQL)

▷ Schema creation and population
▷ Workload operations

EXAMPLES: WORKLOAD OPERATIONS

▷ A technician can look for raised warnings

```
SELECT * FROM Warning WHERE patient_ID = '504-86-182' AND measurement_timestamp > '1950-01-01';
```

▷ Creation of a new Patient's account

```
INSERT INTO Patient (patient_health_code, password, name, surname, date_of_birth, telephone_number, home_address)
VALUES ('873-12-540', 'password example', 'Monica', 'Verdi', 19751004, '3456766789', 'Piazza Rotonda 30/14A') IF NOT EXISTS;
```

▷ Consistency setting

```
6    -- For strong consistency
7
8    CONSISTENCY LOCAL_QUORUM;
```

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LIGHTWEIGHT TRANSACTION

▷ Consistency setting

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7
8    CONSISTENCY LOCAL_QUORUM;
```

THANKS!

REFERENCES

▷ http://cassandra.apache.org/

▷ https://www.datastax.com

▷ https://github.com/riptano/ccm

▷ http://www.freedatagenerator.com

▷ https://www.trifacta.com