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Spatial and Big Data Services for Lower Cost, Better Quality Healthcare Systems

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Senior Principal Product Manager
Oracle
January 24, 2017

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Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

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CDC A-Z INDEX

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FIGURE 1. U.S. Department of Health and Human Services public health regions*

* *1* = Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; *2* = New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands (Mortality data for residents of U.S. territories were excluded.); *3* = Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; *4* = Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; *5* = Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; *6* = Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; *7* = ... kota, Sou ... ada; *10* =

- **Age-cause-state-locality** summed over age groups to provide cause-specific estimates over 10 US Department of Health and Human Services public health regions

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eborah D. Ingram, PhD[1]; M
F. Iademarco, MD[2] (View

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al areas) compared with m ... ssessed.

tem were used to calculate age-adjusted death rates and potentially excess deaths for nonmetropolitan
d all ages and were adjusted to the 2000 U.S. standard population by the direct method. Potentially
umbers that would be expected if the death rates of states with the lowest rates (i.e., benchmark states)
tes for each cause during 2008–2010.) Potentially excess deaths were calculated separately for
d the 10 U.S. Department of Health and Human Services public health regions.

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- **Rural areas** have higher death rates from the five leading causes of death

Some causes

- Fewer healthcare providers, less preventive care
- Long travel distances for specialty and emergency care

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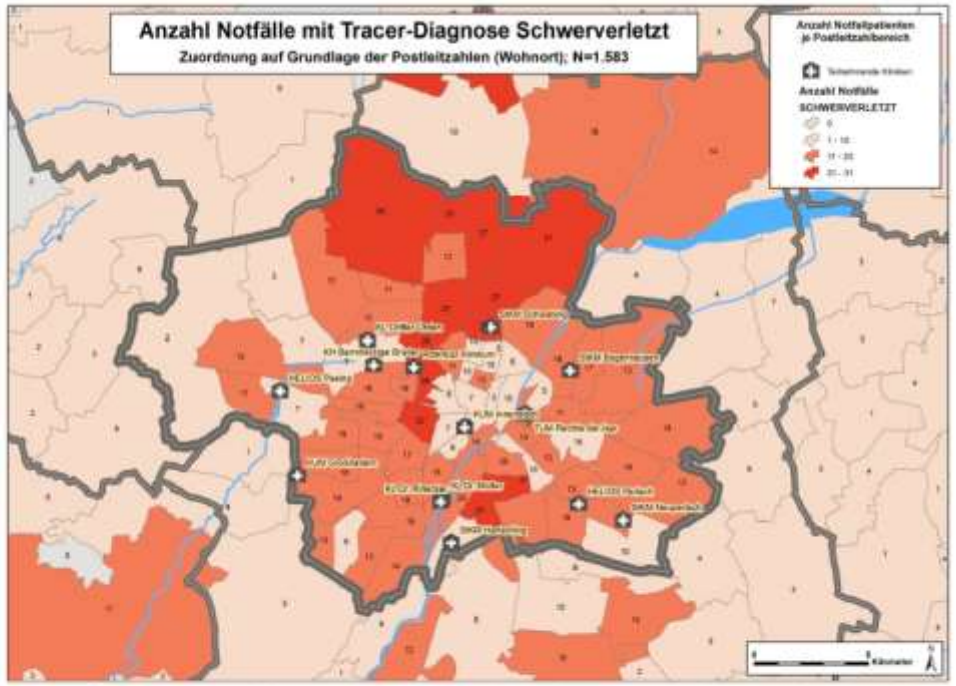
Improve Emergency Services Planning, Bavaria

Oracle Spatial and Graph Routing Solution

GEO- und einsatzdatenbasierte Analyse und Optimierung



INM (2015) Notfallversorgung Landeshauptstadt München - Ergebnisse der Ist-Stand-Analyse, Runder Tisch Notfallversorgung

39 16.03.2016

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Internetportale – Einbindung MapViewer

MapViewer – Analysen (Luftrettungsststandorte, RTH Bayern – Einsatzradien 60 km, aktuell)

Technology Trends

Rapid Impact on Digital Health

Three Major Trends

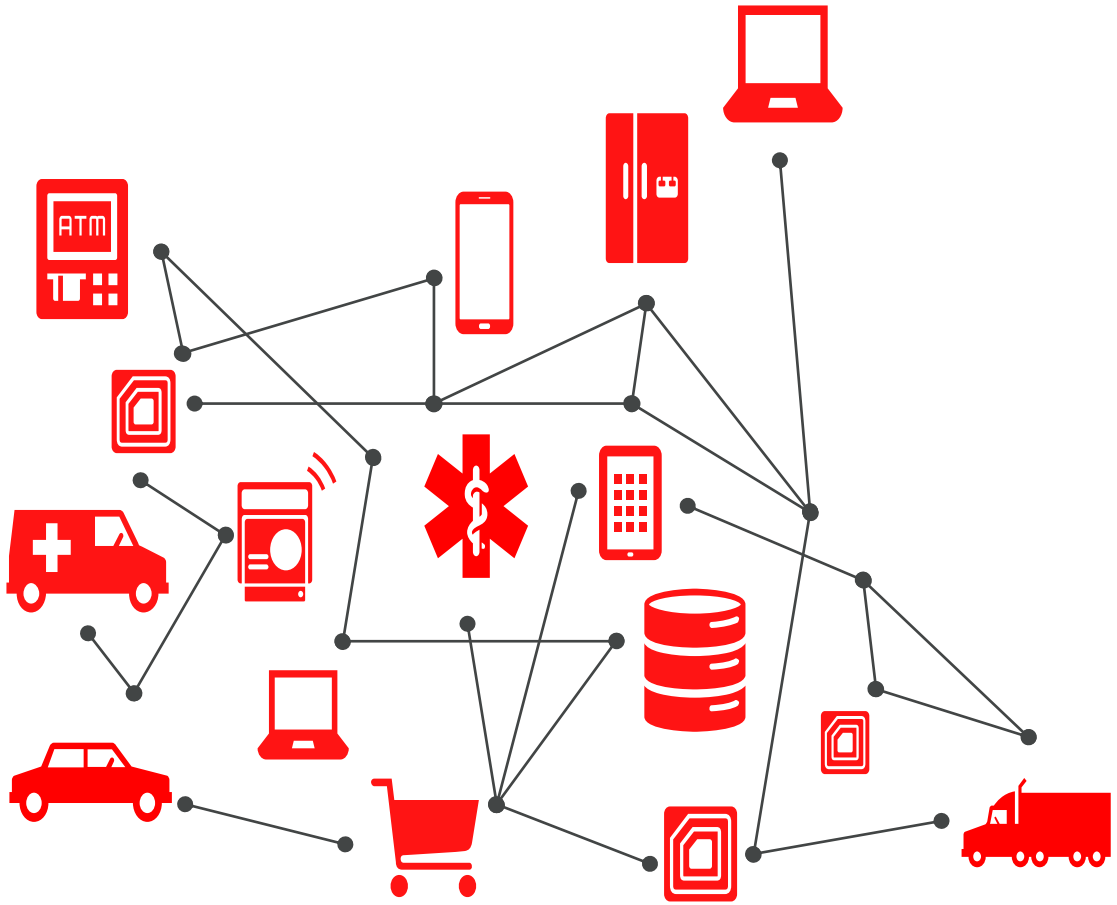
- Big Data
- Advanced analytics
- Cloud computing

1. Big Data

1. Big Data

Old and New Data Sources

- Electronic health records
- Genomic sequencing
- Mobile sensors
- Insurance claims
- Social media
- Track food purchases



Sensors and Wearable Devices

- Fitness activity trackers
  - Watches and trackers reach 110 million in sales in 2016
  - Smart phone penetration will surpass 6 billion by 2020
  - **Low cost way to track and improve population health**

- Biosensors
  - Physiological measurements: Heart rate, skin temperature, blood oxygen levels

- Smartphone apps to transmit data: weight, BP, heart rate

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RESEARCH ARTICLE

Digital Health: Tracking Physiomes and Activity Using Wearable Biosensors Reveals Useful Health-Related Information

Xiao Li, Jessilyn Dunn, Denis Salins, Gao Zhou, Wenyu Zhou, Sophia Miryam Schüssler-Fiorenza Rose, Dalia Perelman, Elizabeth Colbert, Ryan Runge, Shannon Rego, Ria Sonecha, Somalee Datta, Tracey McLaughlin, Michael P. Snyder

Published: January 12, 2017 • http://dx.doi.org/10.1371/journal.pbio.2001402

Article | Authors | Metrics | Comments | Related Content

Abstract

A new wave of portable biosensors allows frequent measurement of health-related physi
We investigated the use of these devices to monitor human physiological changes durin
various activities and their role in managing health and diagnosing and analyzing diseas
recording over 250,000 daily measurements for up to 43 individuals, we found personalized circadian differences in physiological parameters, replicating previous physiological findings. Interestingly, we found striking changes in particular environments, such as airline flights (decreased peripheral capillary oxygen saturation [SpO_2] and increased radiation exposure).

Published January 12, 2017

- Track heart rate, skin temperature and blood oxygen levels continuously

Results

- Identify onset of Lyme disease and inflammation before external symptoms
- Detect risk for type 2 diabetes

Flight testing

Measurement equip...

journals.plos.org/plosbiology/

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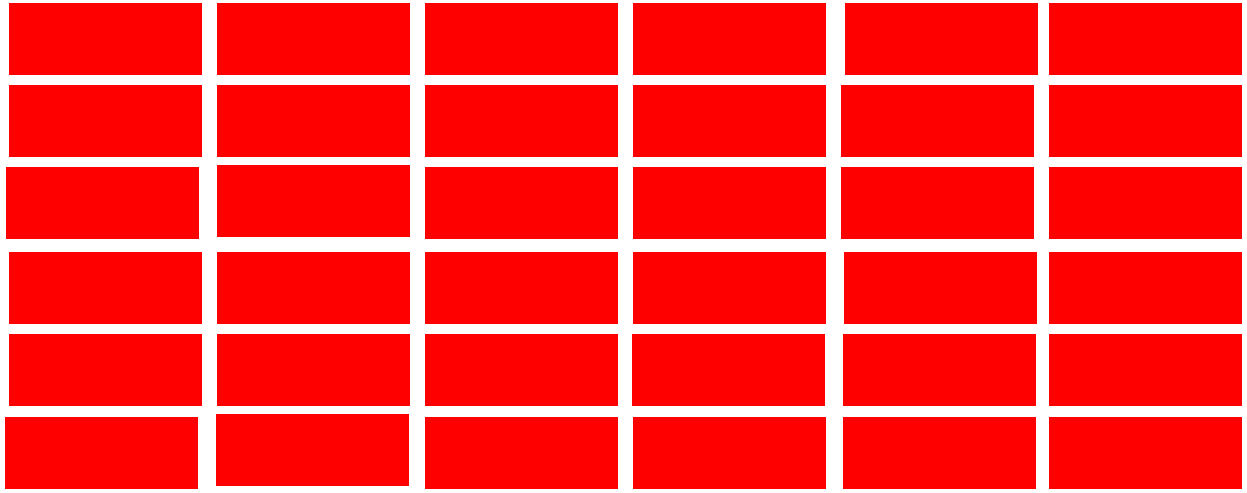
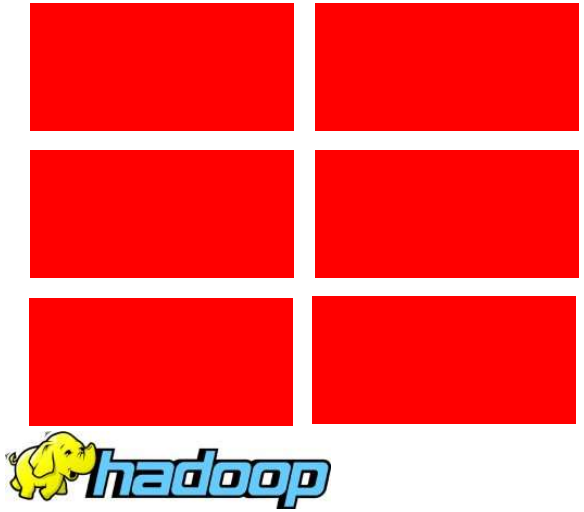
Large Scale Data Processing with Cluster Computing



In memory cluster computing

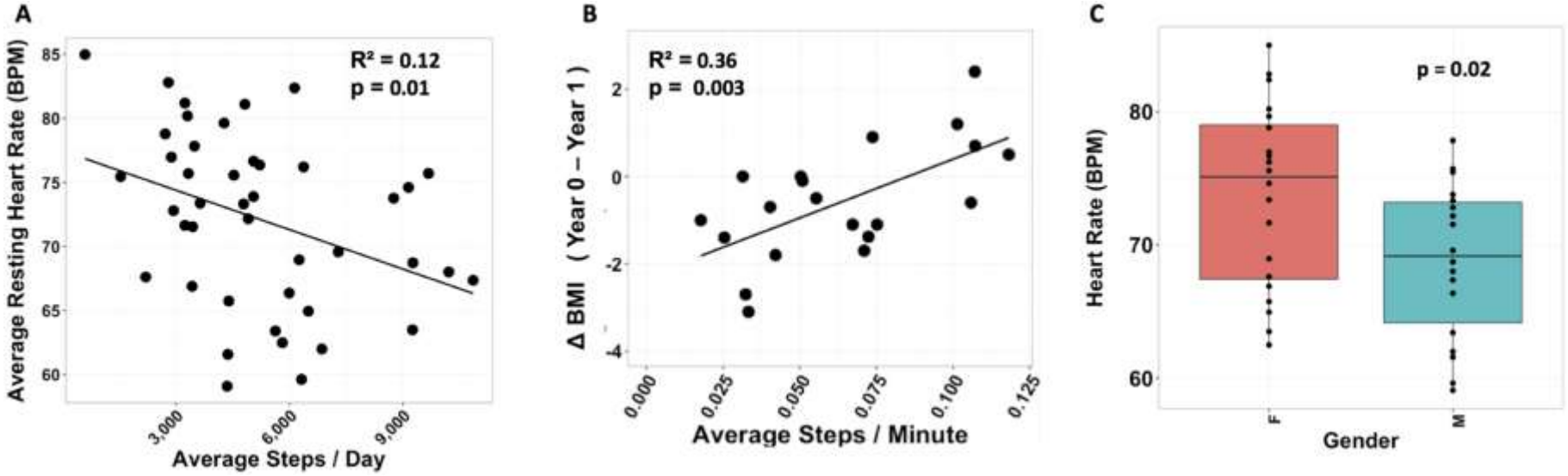
Big Data Platform



Process sensor data and identify interesting events

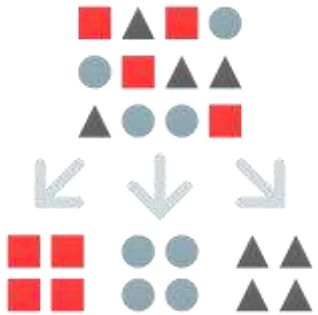
Store an interesting event

2. Advanced Analytics



Li X, Dunn J, Salins D, Zhou G, Zhou W, et al. (2017) Digital Health: Tracking Physiomes and Activity Using Wearable Biosensors Reveals Useful Health-Related Information. PLOS Biology 15(1): e2001402. doi:10.1371/journal.pbio.2001402
http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2001402

Spatial Analysis



- What is an optimal way to identify the **nearest** trauma facility? Which **water source** could have caused the diarrhea outbreak measured at this **clinic?**
- Link disparate sources of Big Data by location
  Example: Tweet + location of sensor + insurance claim address
- Mapping and Visualization of analysis results
- Categorization, clustering and filtering based on location and proximity

3. Cloud Computing

Cost Reduction

Reduce Overhead

Develop and deploy quickly

Flexibility

Oracle Cloud Services

Examples

Oracle Big Data Cloud Service

Oracle Big Data Spatial and Graph
Oracle Advanced Analytics
and more

Oracle Database Cloud Services

Oracle Spatial and Graph
Oracle Advanced Analytics
and more

Oracle Storage Cloud Service

Tracking Disease at the World's Largest Religious Festival: Kumbh Mela

- **30 million** people visit to bathe in holy waters

Water and Sanitation

- 46 tubewells
- 600+ km pipes
- 92 million liters/day clean water
- 35,000 temporary toilets
- 7,000+ night soil sweepers

A Harvard South Asia Institute Initiative

Courtesy: Dr. Satchit Balsari and the Jana Swasthya team

Track Disease in Real-Time

EMCounter Disease Surveillance System

- Real-time upload in 35 medical clinics through mobile devices
- View patient trends in real-time throughout the festival
- **Cloud technology enabled easy access and sharing by doctors, policy makers, data analysts, and others**

Actionable Data in Real-Time

- Identify festival locations that need additional doctors, nurses, medical supplies
- When a surge in diarrhea was observed at a clinic, track water source to shut it down
- Identify unusual illness patterns

Spatial and Graph Technologies at Oracle

Oracle Database Spatial and Graph

Oracle Big Data Spatial and Graph

Spatial and Graph Cloud Offerings

Integrated Cloud

Applications & Platform Services

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