

Imagine IoT

1.4 New Process Paradigms: Big Data and Artificial Intelligence



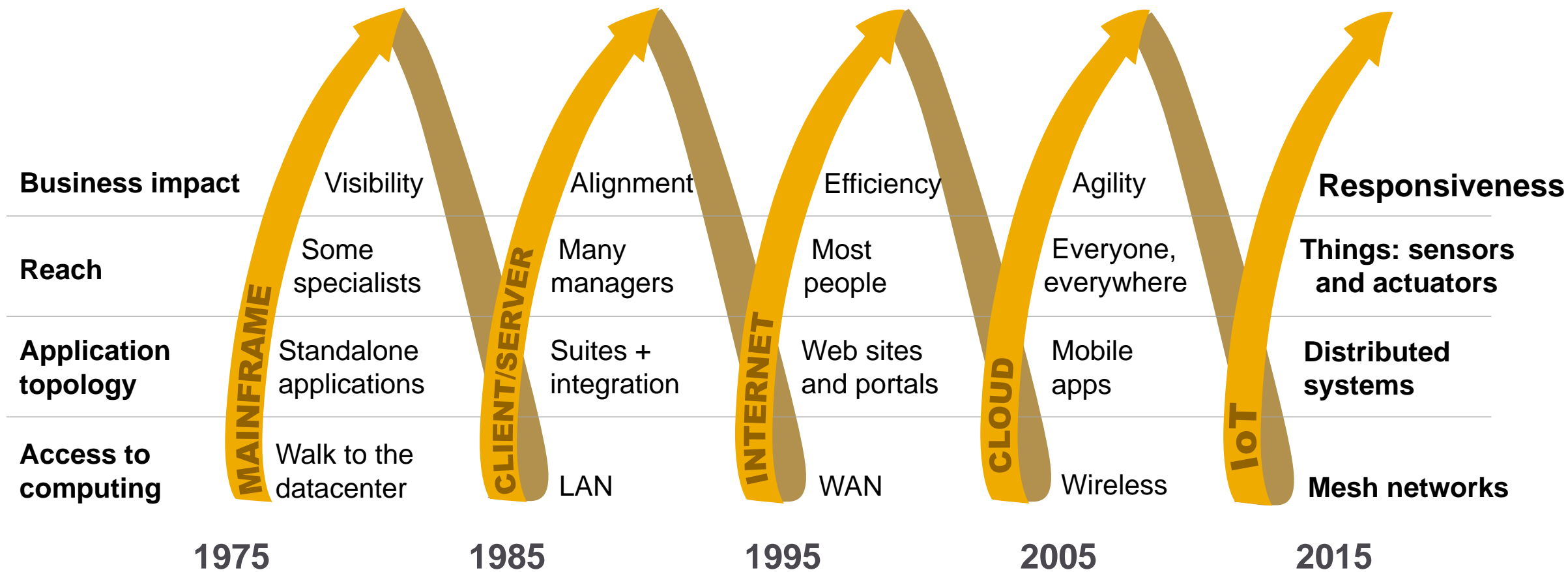
open**SAP**

How will IoT change business processes

...and what is the new paradigm?

New Process Paradigms: Big Data and Artificial Intelligence

Technology reshapes business



New Process Paradigms: Big Data and Artificial Intelligence

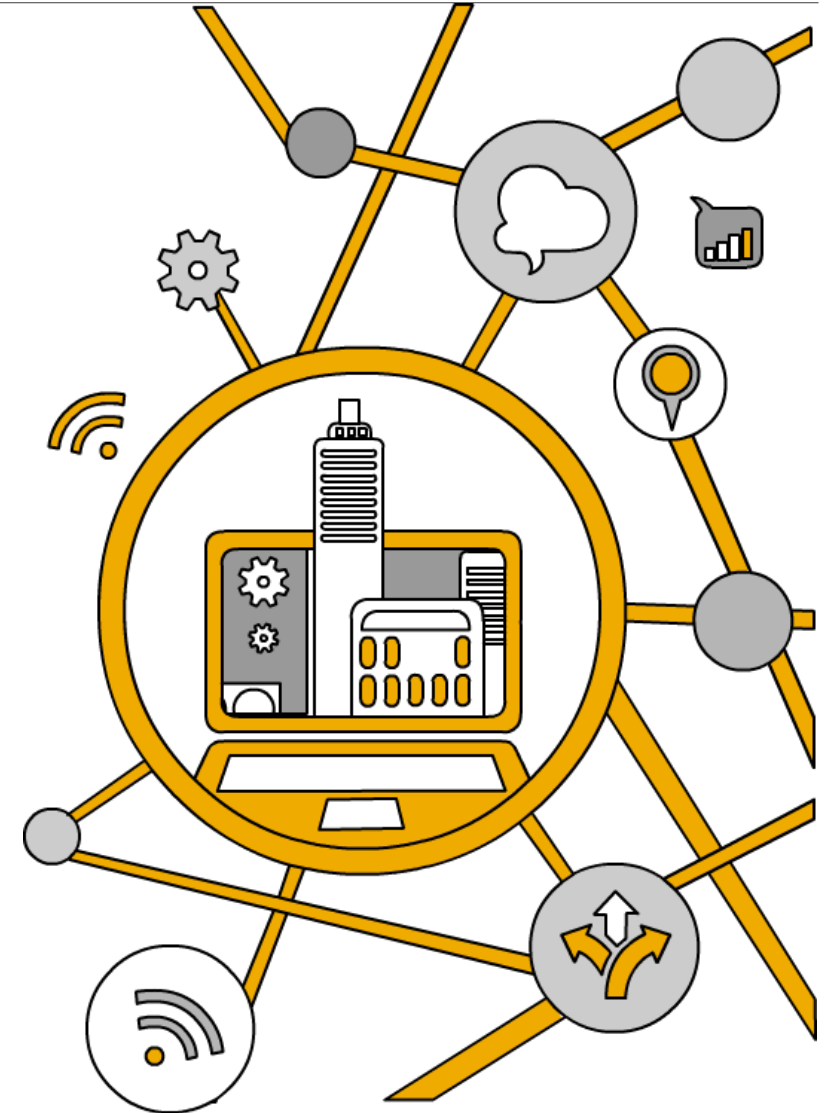
Autonomic nervous systems for organizations

Nothing goes away

- Reports
- Dashboards
- Transactions
- Applications
- Web sites
- Mobile apps

Something is added

- Ability to **sense** and **respond** to changes in the environment
- Meeting **customer needs** as soon as—or even before—they are noticed by people
- **Reactive and proactive**



New Process Paradigms: Big Data and Artificial Intelligence

Example of an autonomic business process

1. Cooling unit shows subtle pattern of vibrations
2. IoT system predicts refrigeration failure in hours
3. Message to driver re-routes truck to transfer depot
4. Message to another driver brings another truck to pick up payload
5. Parts for repair automatically ordered, sent to maintenance yard
6. Load transfers, truck is routed to maintenance yard and removed from service
7. Near-future deliveries scheduled for this truck are re-planned to other trucks



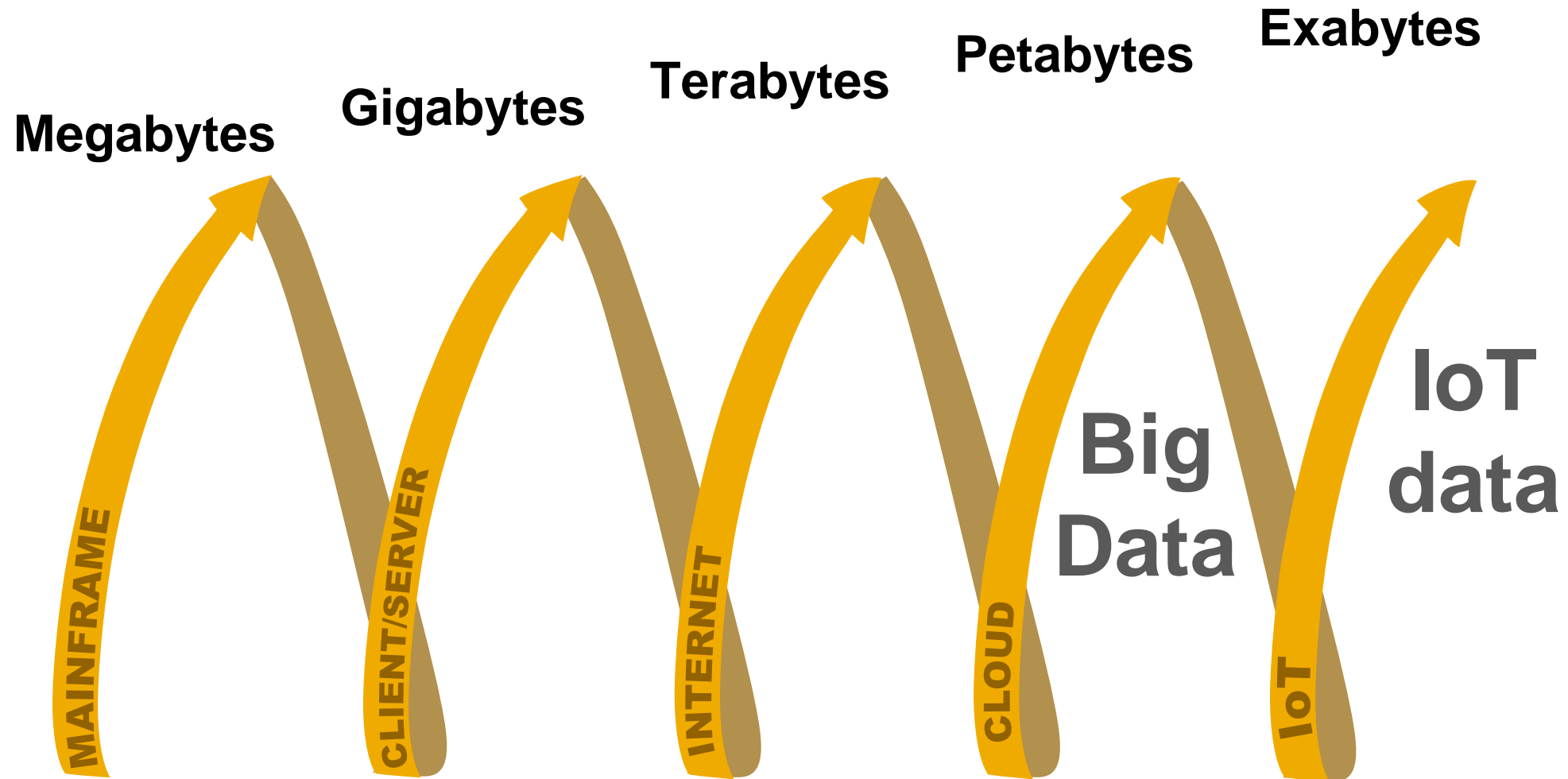
All done automatically

What is Big Data

...and how does it compare to IoT data?

New Process Paradigms: Big Data and Artificial Intelligence

Dataset sizes



New Process Paradigms: Big Data and Artificial Intelligence

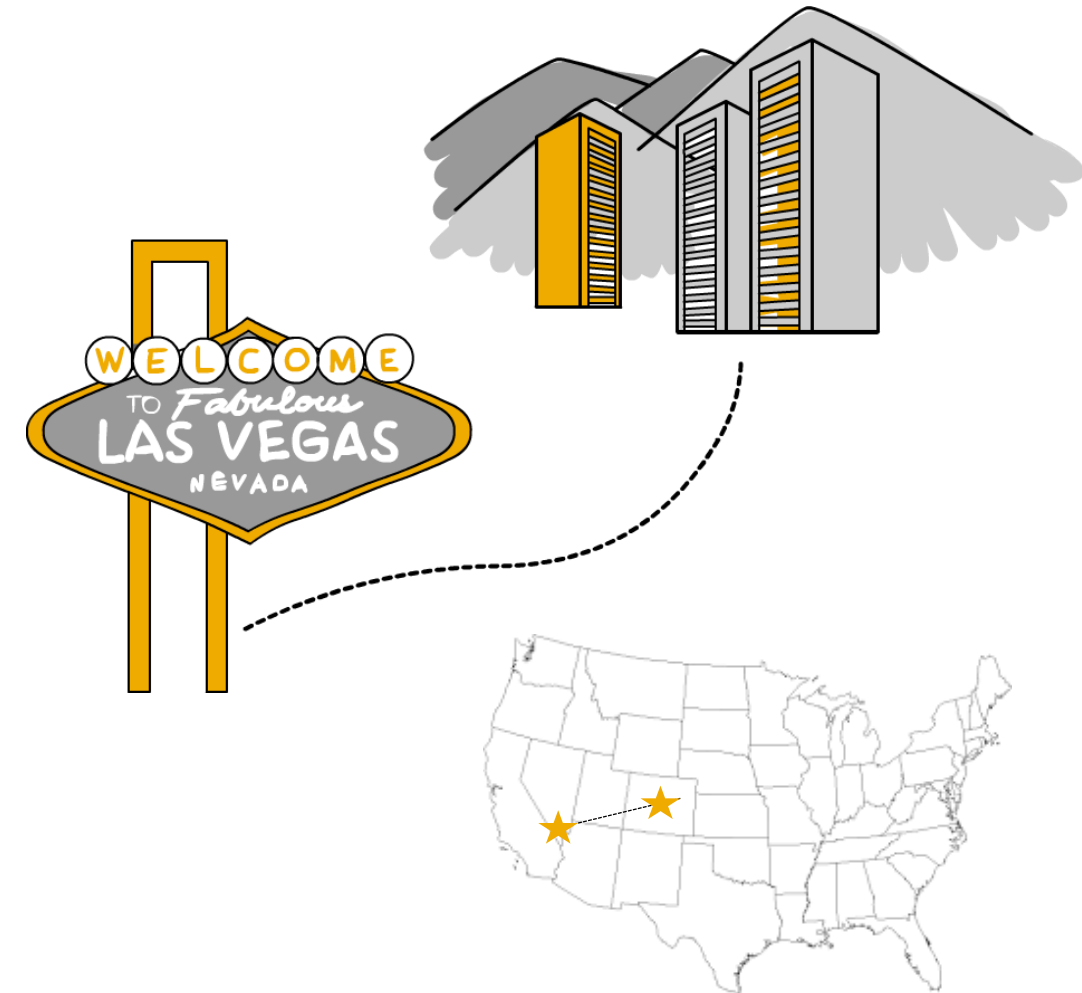
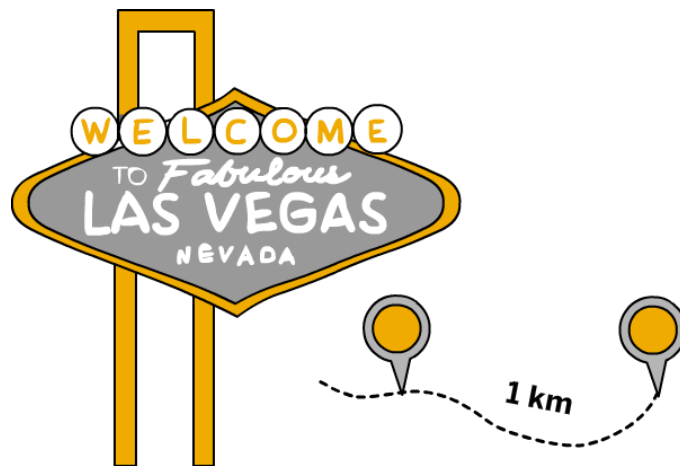
How much bigger is IoT data?

Type of data	Recommended SAP data management solution	Size range	Expressed numerically
Transactional data	SAP HANA – in-memory	Terabytes (TB)	10^{12}
Traditional analytics (OLAP)	SAP IQ or SAP HANA dynamic tiering – disk-based	10s to 100s of terabytes	10^{13-14}
Big Data	Hadoop with SAP HANA Vora – both in-memory & disk-based	Petabytes (PB)	10^{15}
IoT data	SAP SQL Anywhere distributed as an edge database	Exabytes (EB)	10^{18}

New Process Paradigms: Big Data and Artificial Intelligence

How big is an exabyte?

Size range	Analogy to distance	How far you would have to walk
Terabyte (10^{12})	1 meter	Walk 2 steps
Petabyte (10^{15})	1 kilometer	Walk half the length of the Las Vegas strip
Exabyte (10^{18})	1000 kilometers	Walk from Las Vegas to Denver, Colorado



New Process Paradigms: Big Data and Artificial Intelligence

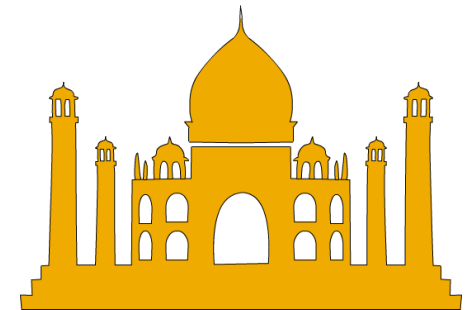
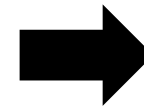
Will IoT datasets really get this big?

Large car manufacturer – numbers provided by customer

- ❑ 100 million cars (10-year lifespan) x 4 messages/day x 25-kilobyte messages = 10 terabytes/day = 3½ petabytes/year x 10 years of data = 3% of 1 exabyte
- ❑ Could grow to 200 messages/day x 50-kilobyte messages → **3½ exabytes**

Gartner estimate: 50 billion connected devices by 2020

- ❑ Conservative assumption: average 500-byte message per minute per device
- ❑ 50 billion devices x ½ million minutes/year x ½ kilobyte = **12½ exabytes/year**
= like walking from Las Vegas to Delhi!



What is the edge

...and why is it so important for IoT?

New Process Paradigms: Big Data and Artificial Intelligence

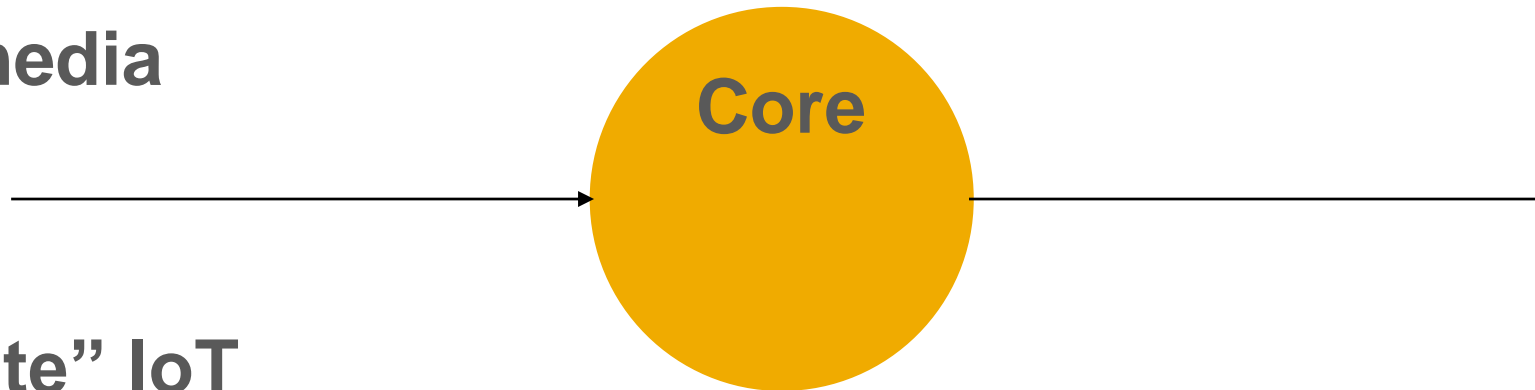
Where will IoT data reside and how will it flow? (1)

“Light Content”

(info, news, marketing)

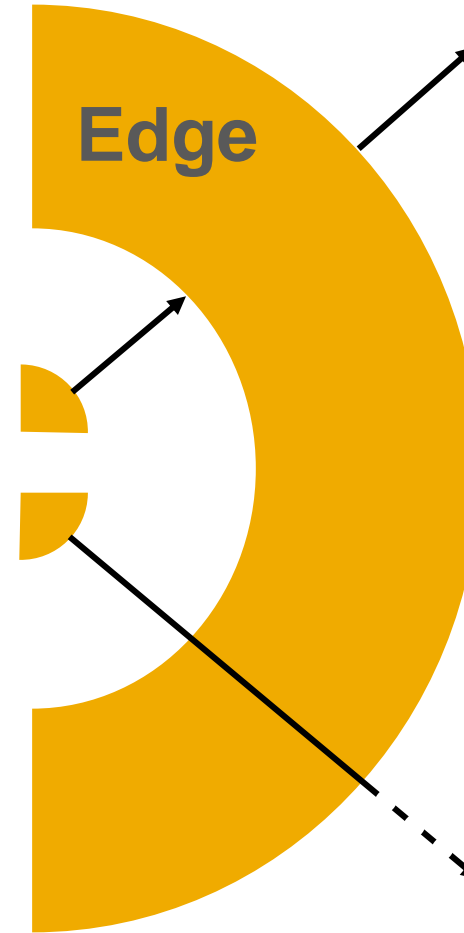
Commerce

Social media



New Process Paradigms: Big Data and Artificial Intelligence

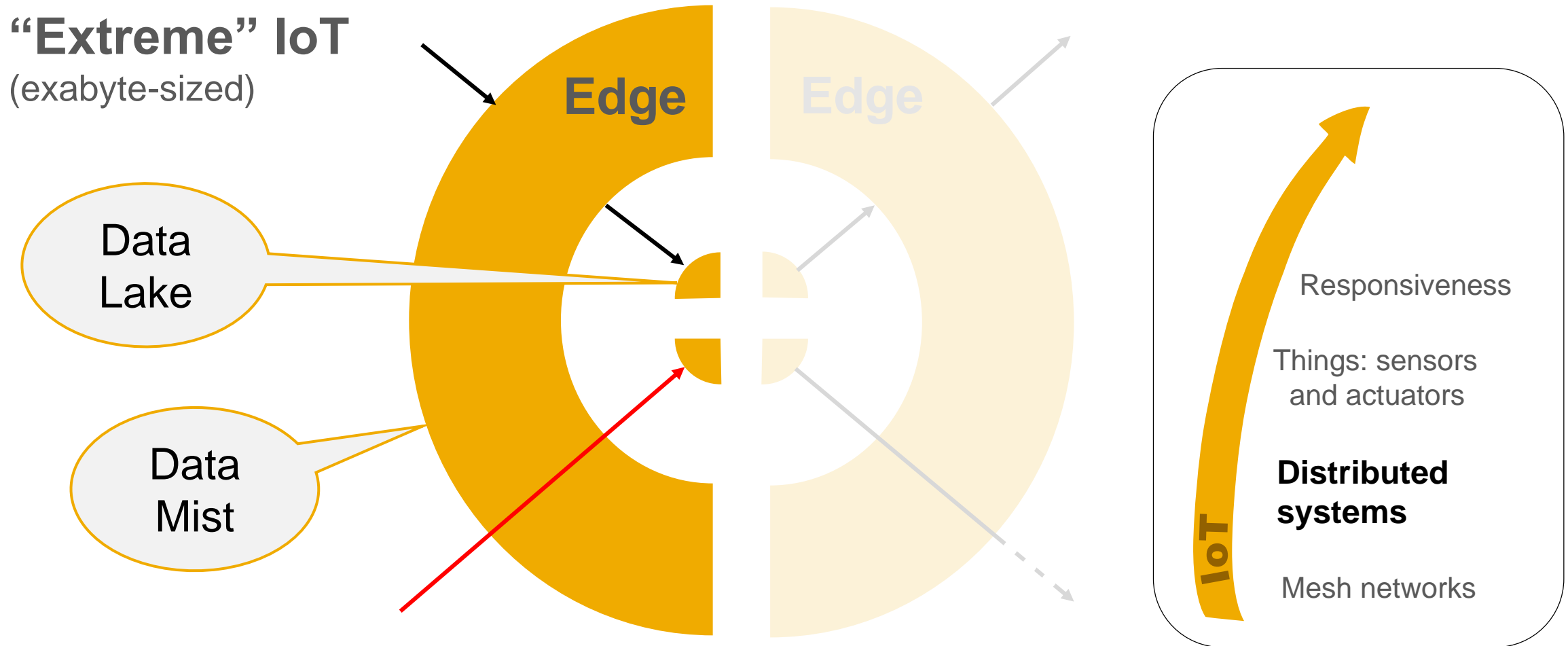
Where will IoT data reside and how will it flow? (2)



Video

New Process Paradigms: Big Data and Artificial Intelligence

Where will IoT data reside and how will it flow? (3)



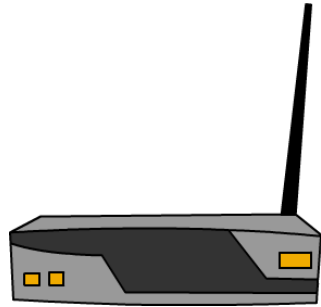
New Process Paradigms: Big Data and Artificial Intelligence

What does the “edge” look like?

Edge gateways



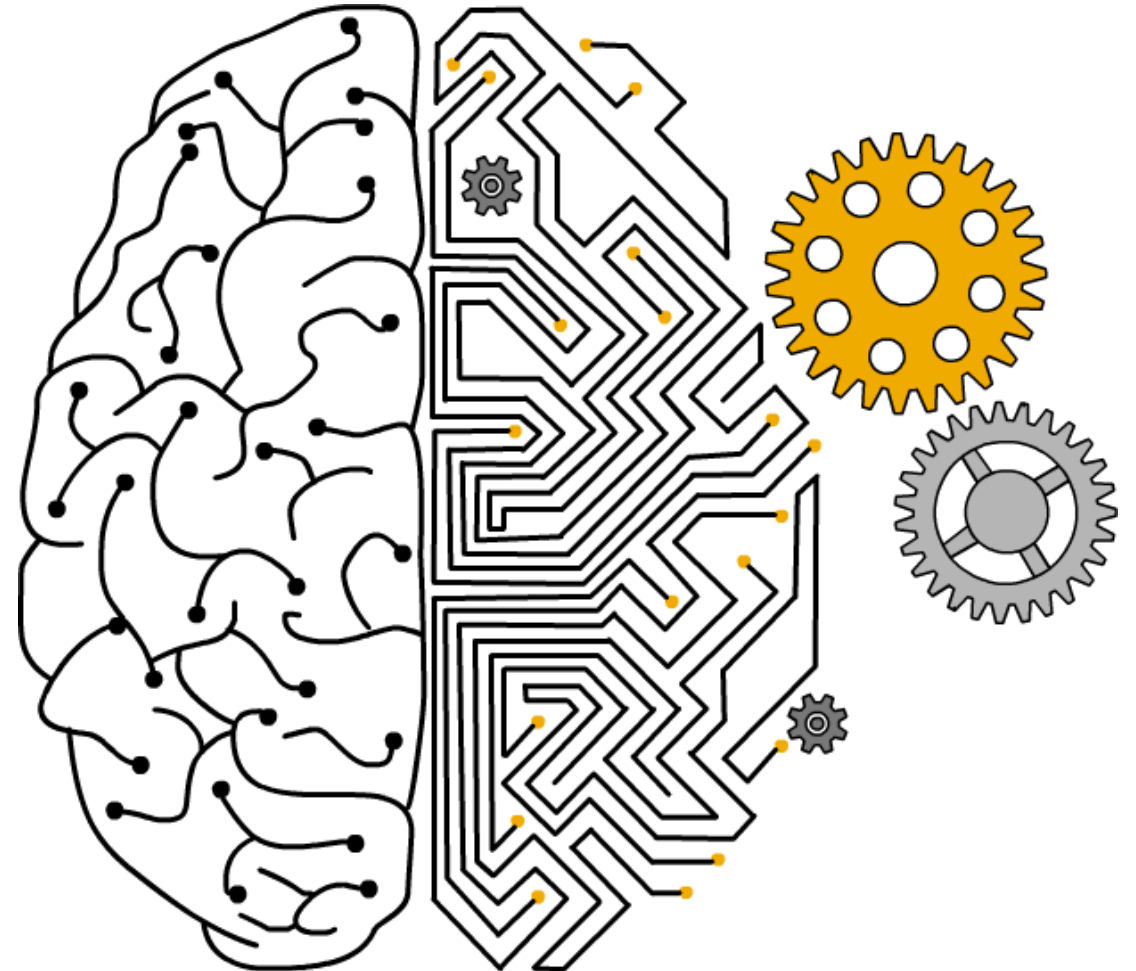
Remote servers



IoT gateways (Intel, Dell, Cisco...)



Raspberry Pi, etc.



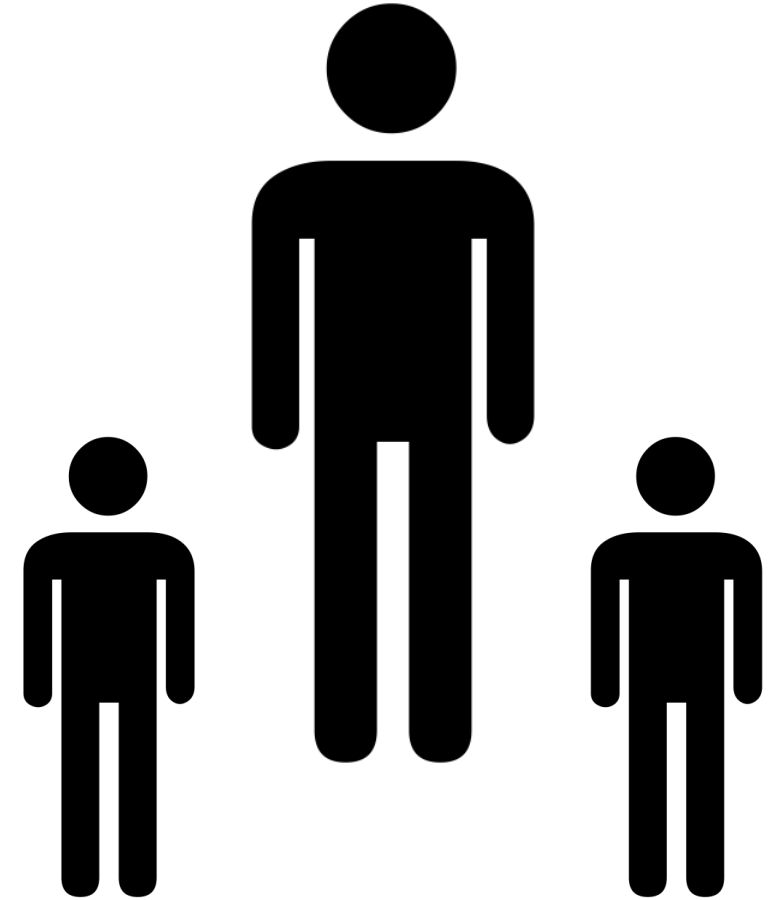
The latest trends involving automation, AI, and bots

...and how are they relevant for IoT?

New Process Paradigms: Big Data and Artificial Intelligence

IoT is beyond human scale

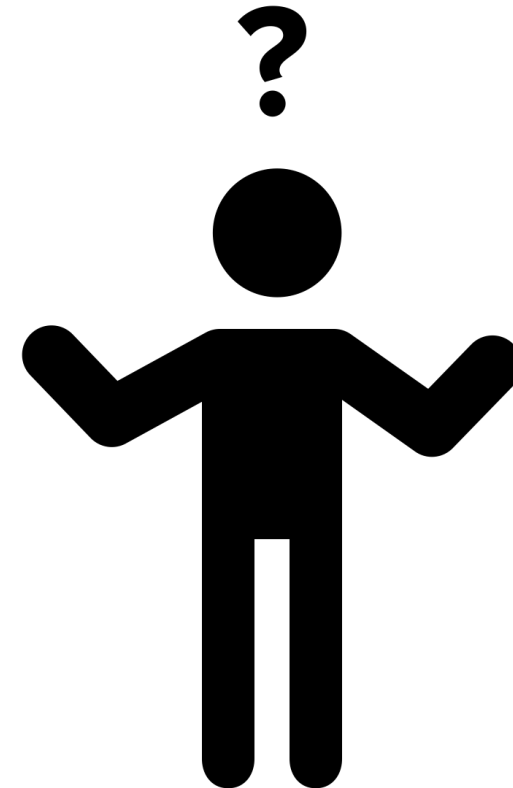
- **Billions** of sensors
- **Millions** of edge gateways
- **Terabytes** generated every day
- **Exabyte-sized** datasets
- **Manual techniques do not work at this scale**



New Process Paradigms: Big Data and Artificial Intelligence

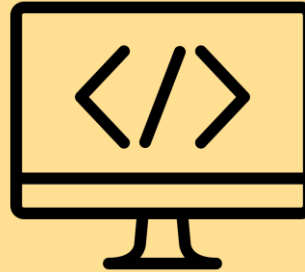
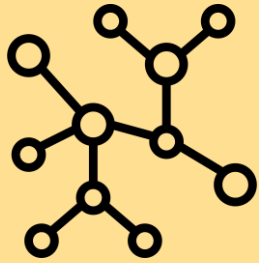
IoT is here to serve human needs

- How do we tame this **scale mismatch**?
- How do we make IoT **manageable**?



New Process Paradigms: Big Data and Artificial Intelligence

Automated delivery and governance of distributed systems



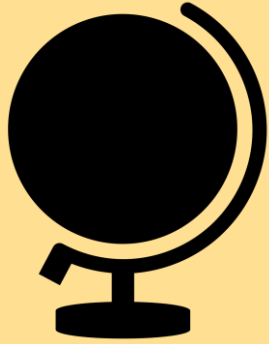
- Thousand-node clusters in the core
- Millions of gateways
- How to deploy and govern at this scale?
- DevOps – responsible for how much their code operates in real use

OpsDev

- Highly-skilled developers focused on delivery and governance
- Building semantic models to drive fully automated operation
- Zero-touch

New Process Paradigms: Big Data and Artificial Intelligence

Machine learning to extract signals from noise



- Machine learning evolves algorithms to discover patterns
- Leverage human judgment to guide evolution



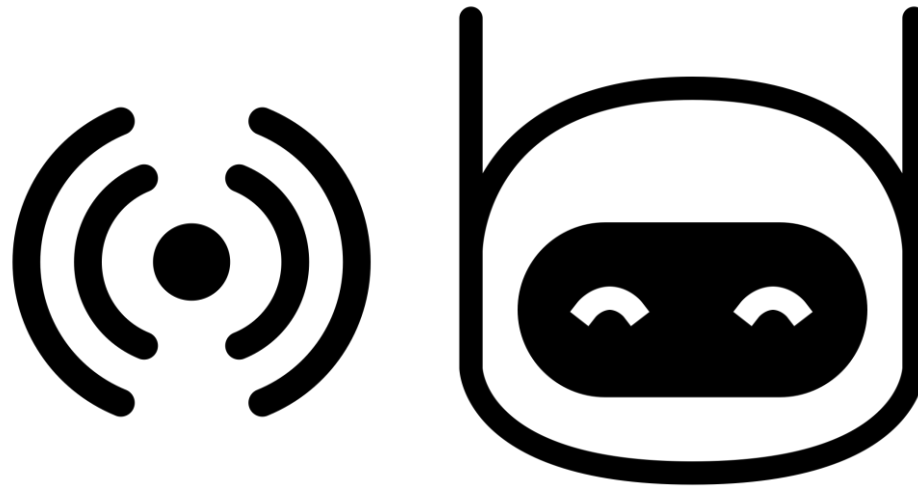
- Any smartphone can now beat a grandmaster
- Freestyle chess: People using computers versus other human-computer teams

New Process Paradigms: Big Data and Artificial Intelligence

Conversational interfaces

Bots

- Software engaging in **conversations** with users
- **Inform** you of events or predictions and **receive your commands** to react to them
- Smarter bots can explain **why** the system thinks something is about to happen

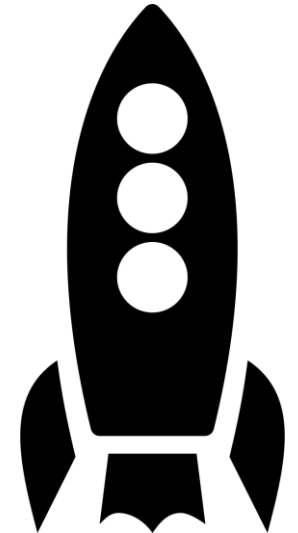


**How do you balance
vision and imagination**
...with pragmatism and delivery of innovation?

New Process Paradigms: Big Data and Artificial Intelligence

Ready, aim, fire

- Start moderately and grow
- Design to provide **responsiveness**, not merely reports
- Plan for **scalability**—successful IoT systems will get very large
- Think in terms of **distributed** systems
- Understand the need to **automate** everything—operations, pattern discovery, generated responses—while building in ways to leverage human insight: **“freestyle”**





Thank you

Contact information:

open@sap.com

open**SAP**

© 2016 SAP SE or an SAP affiliate company. All rights reserved.

No part of this publication may be reproduced or transmitted in any form or for any purpose without the express permission of SAP SE or an SAP affiliate company.

SAP and other SAP products and services mentioned herein as well as their respective logos are trademarks or registered trademarks of SAP SE (or an SAP affiliate company) in Germany and other countries. Please see <http://global12.sap.com/corporate-en/legal/copyright/index.epx> for additional trademark information and notices.

Some software products marketed by SAP SE and its distributors contain proprietary software components of other software vendors.

National product specifications may vary.

These materials are provided by SAP SE or an SAP affiliate company for informational purposes only, without representation or warranty of any kind, and SAP SE or its affiliated companies shall not be liable for errors or omissions with respect to the materials. The only warranties for SAP SE or SAP affiliate company products and services are those that are set forth in the express warranty statements accompanying such products and services, if any. Nothing herein should be construed as constituting an additional warranty.

In particular, SAP SE or its affiliated companies have no obligation to pursue any course of business outlined in this document or any related presentation, or to develop or release any functionality mentioned therein. This document, or any related presentation, and SAP SE's or its affiliated companies' strategy and possible future developments, products, and/or platform directions and functionality are all subject to change and may be changed by SAP SE or its affiliated companies at any time for any reason without notice. The information in this document is not a commitment, promise, or legal obligation to deliver any material, code, or functionality. All forward-looking statements are subject to various risks and uncertainties that could cause actual results to differ materially from expectations. Readers are cautioned not to place undue reliance on these forward-looking statements, which speak only as of their dates, and they should not be relied upon in making purchasing decisions.