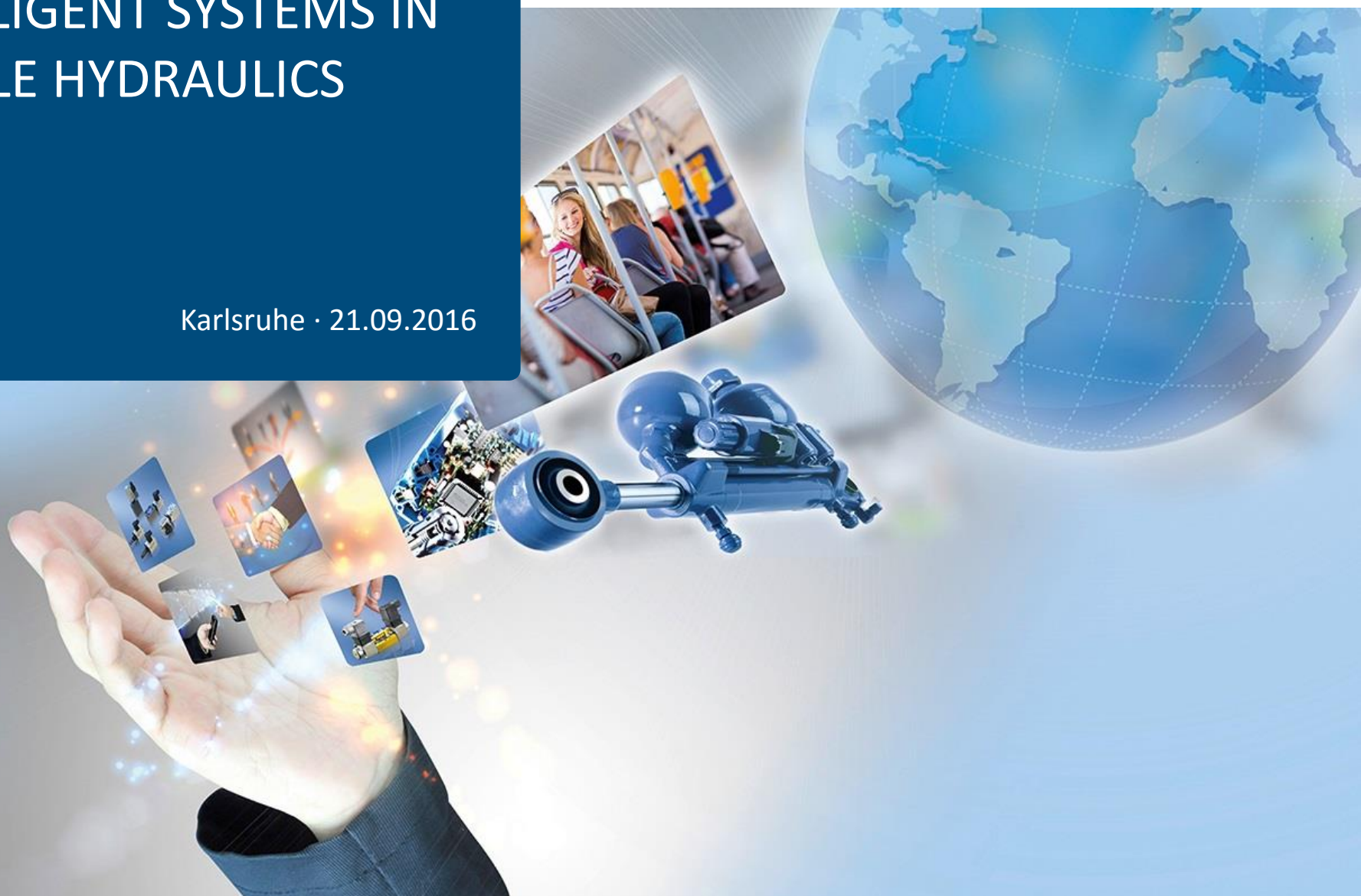


INTELLIGENT SYSTEMS IN MOBILE HYDRAULICS

Karlsruhe · 21.09.2016



Mega Trends

- » Global mega trends are patterns or changes in activities which take place over time and shaping the future

Global Mega Trends



Source: Frost & Sullivan analysis

Mega Trends

- » Innovating to Zero and Connectivity & Convergence are the main drivers for the development of intelligent hydraulic systems

Global Mega Trends



Source: Frost & Sullivan analysis

Innovating to ‚Zero‘

- » Mega trends define the requirements of the future
- » A ‘Zero concept’ world with a vision of *Zero* CO₂ emissions, *Zero* loss, *Zero* down-time



Reduce the energy loss

Lower down time

Decrease operating
cost

Ease the maintenance



Power on demand

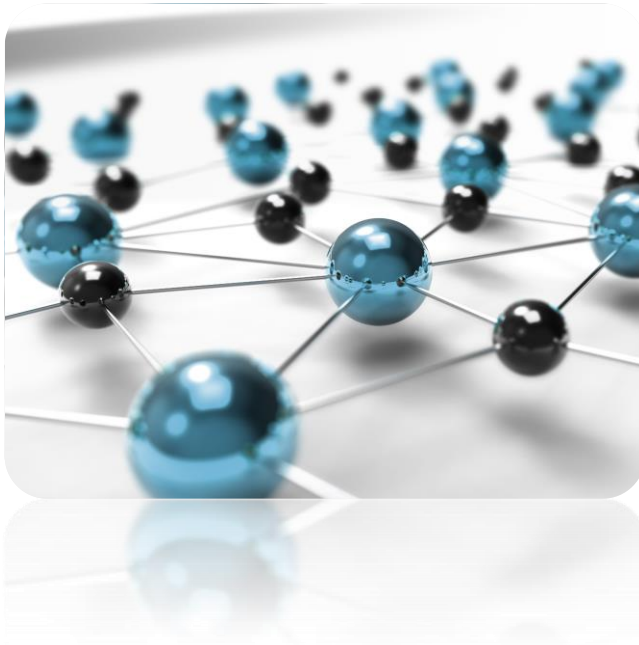
Predictive
maintenance

Maintenance free

Remote diagnostics

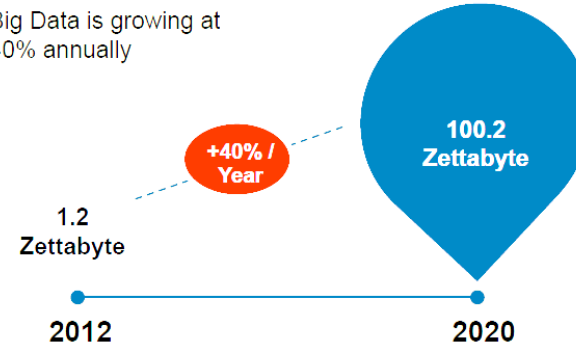
Connectivity and Convergence

- » Megatrends creates opportunities and chances
- » Connectivity enabled us and our devices to communicate, interact and broadcast information

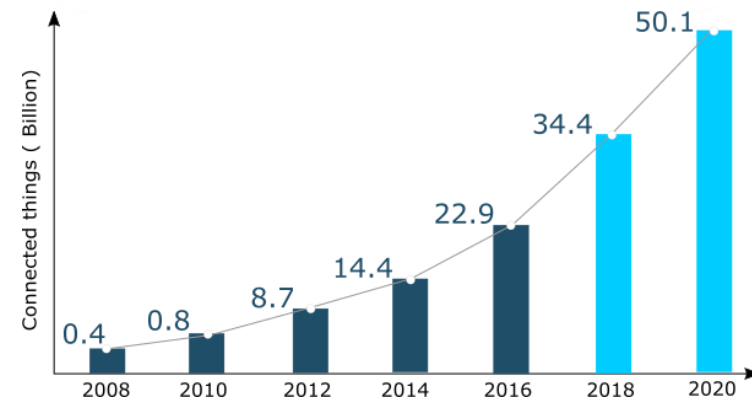


Data Traffic per Year, Global, 2012 and 2020

Big Data is growing at 40% annually



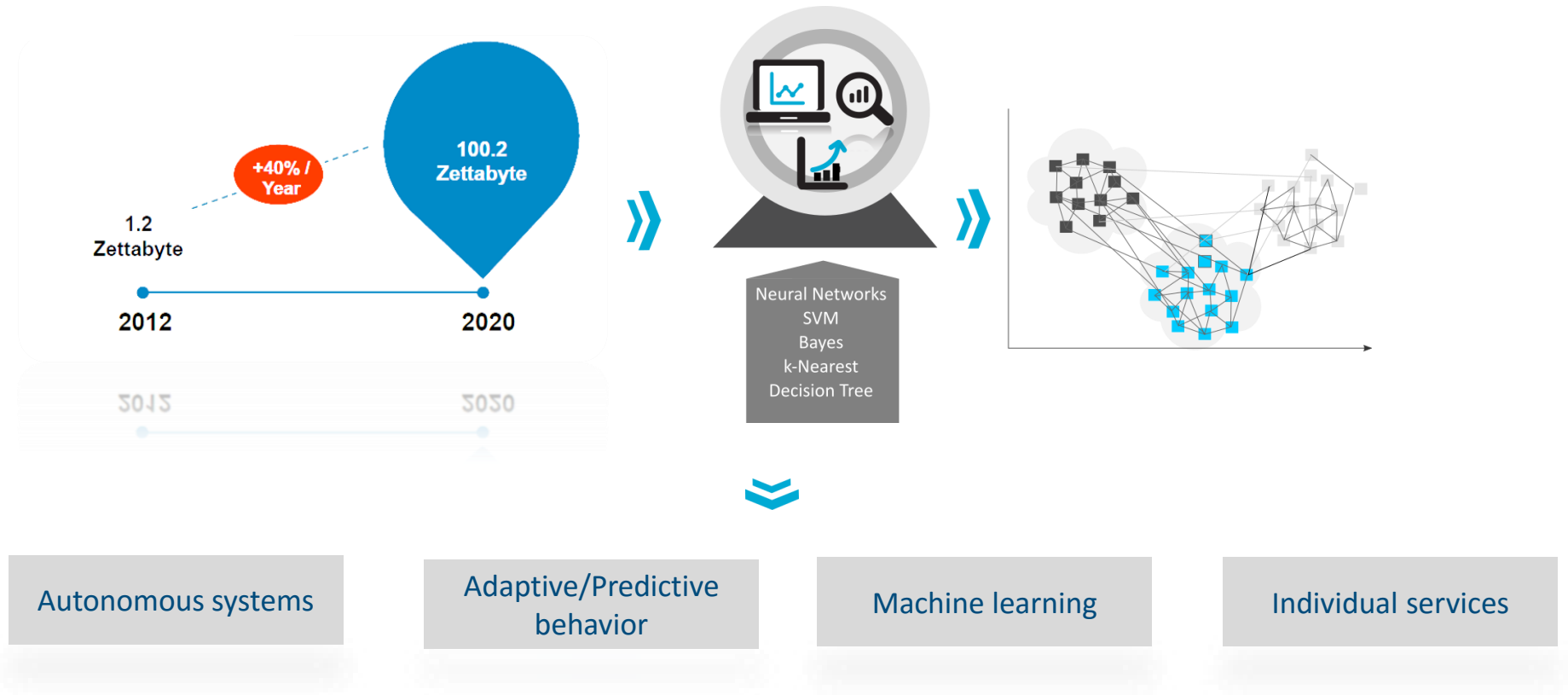
Source: IBM



Source: Cisco

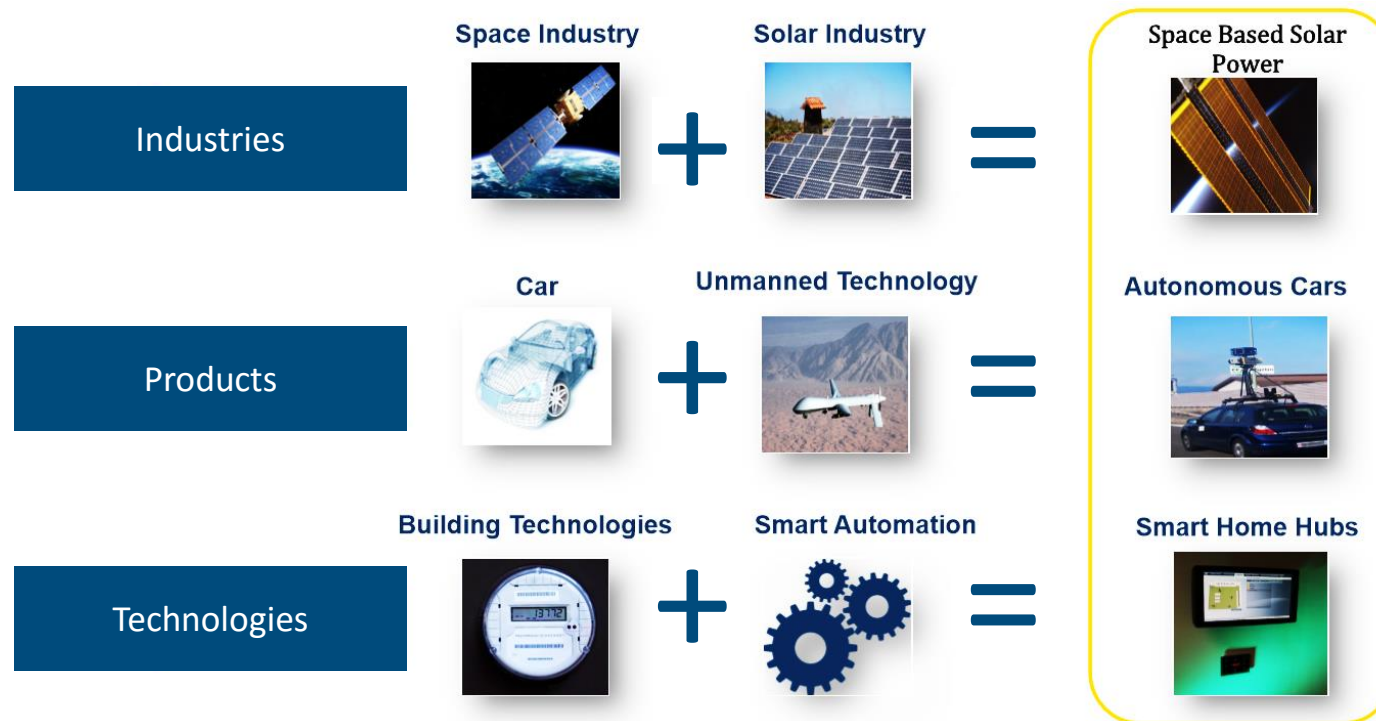
Connectivity and Convergence

- » Data analytics helps to understand the correlation and causality
- » Data driven systems and services become more popular



Connectivity and Convergence

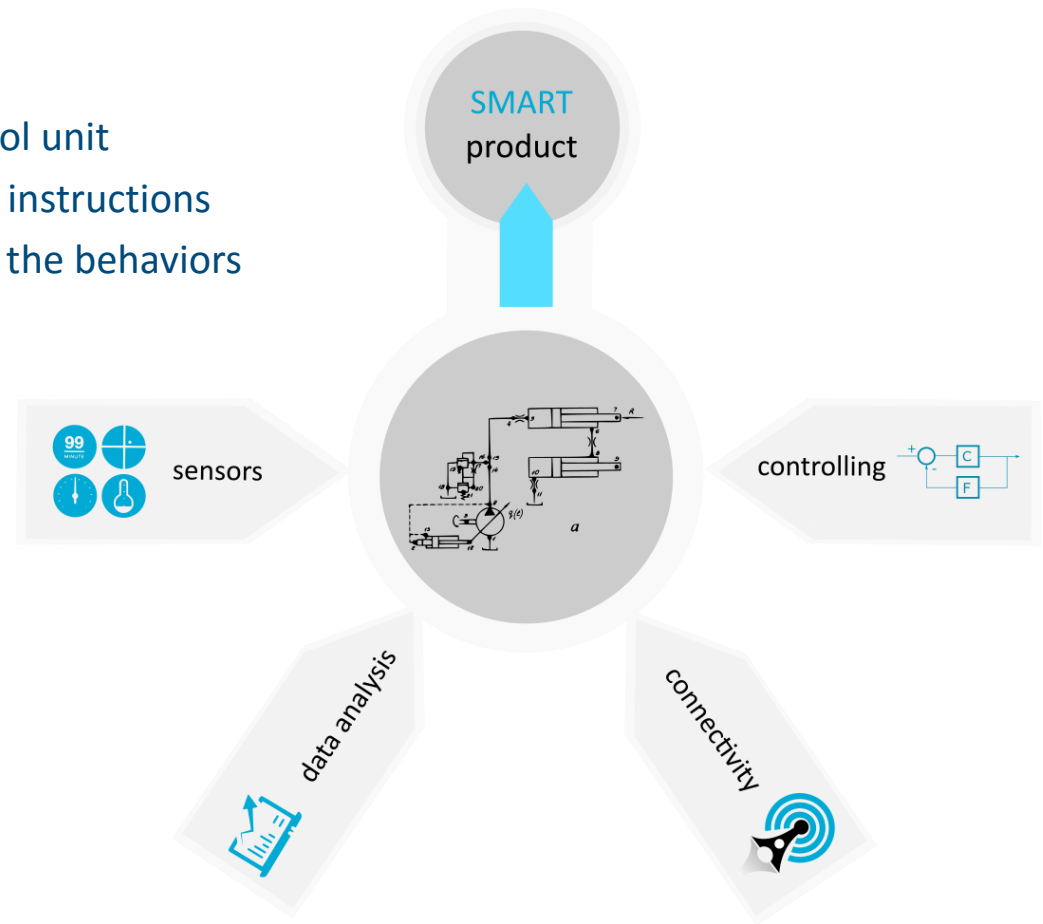
- » Convergence is the integration of products and technologies which leads to emergence of a new system
- » One product, many applications



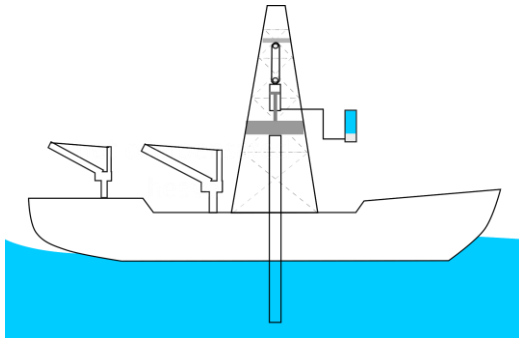
Source: Frost & Sullivan analysis

Intelligent hydraulic systems

- » Integration of electronic components in hydraulic systems
 - › Sensors for signal acquisition
 - › Connectivity elements for transmitting the information to the command-and-control unit
 - › Control units for taking decisions and giving instructions
 - › Data analytics for analysis and prediction of the behaviors
 - › Actuators for performing required action



Drivers



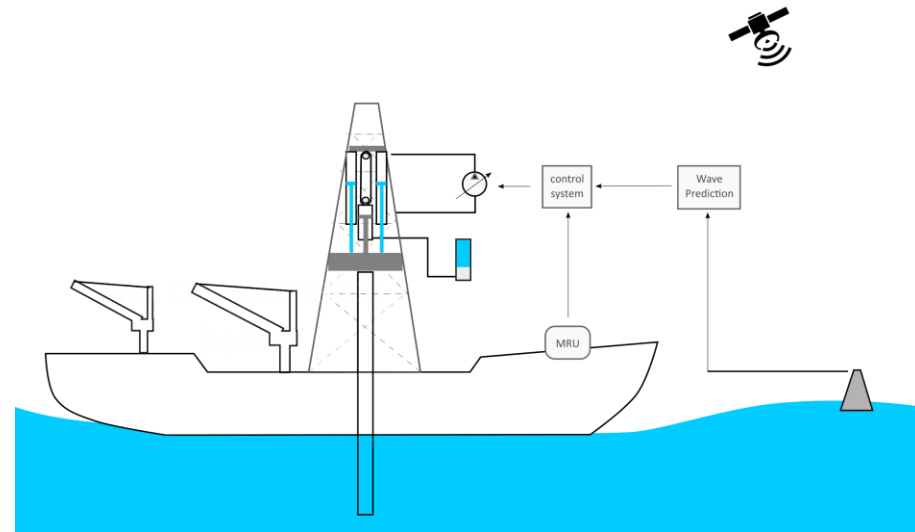
Technology-Push

- Falling prices of sensors
- Increasing in computational power & storage capacity
- Fast developing connectivity
- Data analytics capabilities



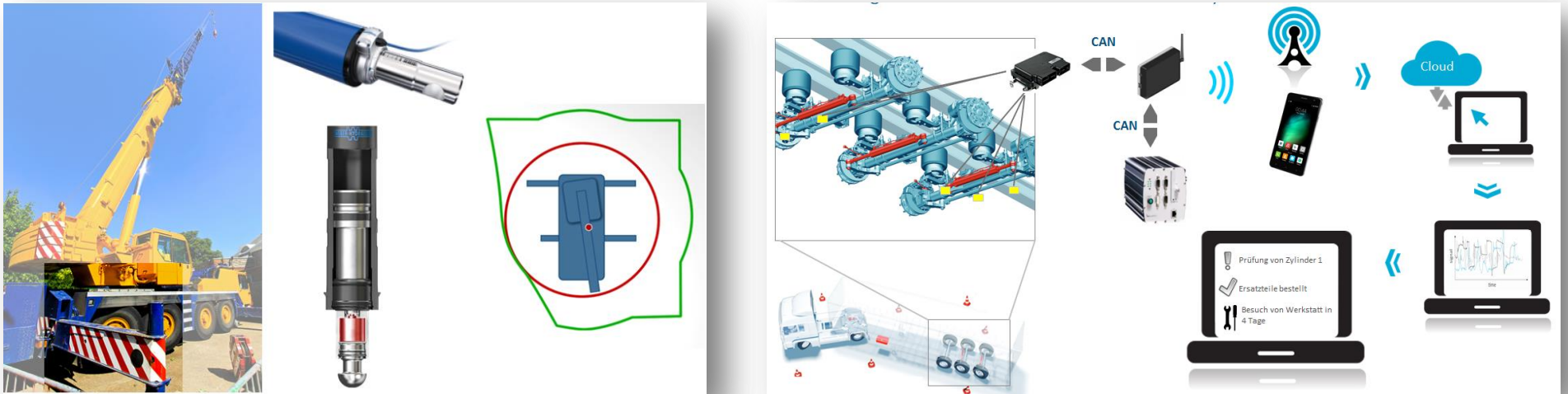
Market-Pull

- Less downtime, more comfort & safety
- Increased efficiency
- Reduced machine cost
- Good controllability and productivity



Benefits

- » Providing added value for user and the manufacturer
 - › New functionality
 - › Resolving undesired problems
 - › Enhancing efficiency



Safety in mobile crane application

Market Pull

- » Reducing risk in restricted supporting conditions (load limiter is mandatory according to Machine Design Guideline 4.2.2)
- » Automated assessment of the stability
- » Increased productivity of the operator



Source: straitstimes.com

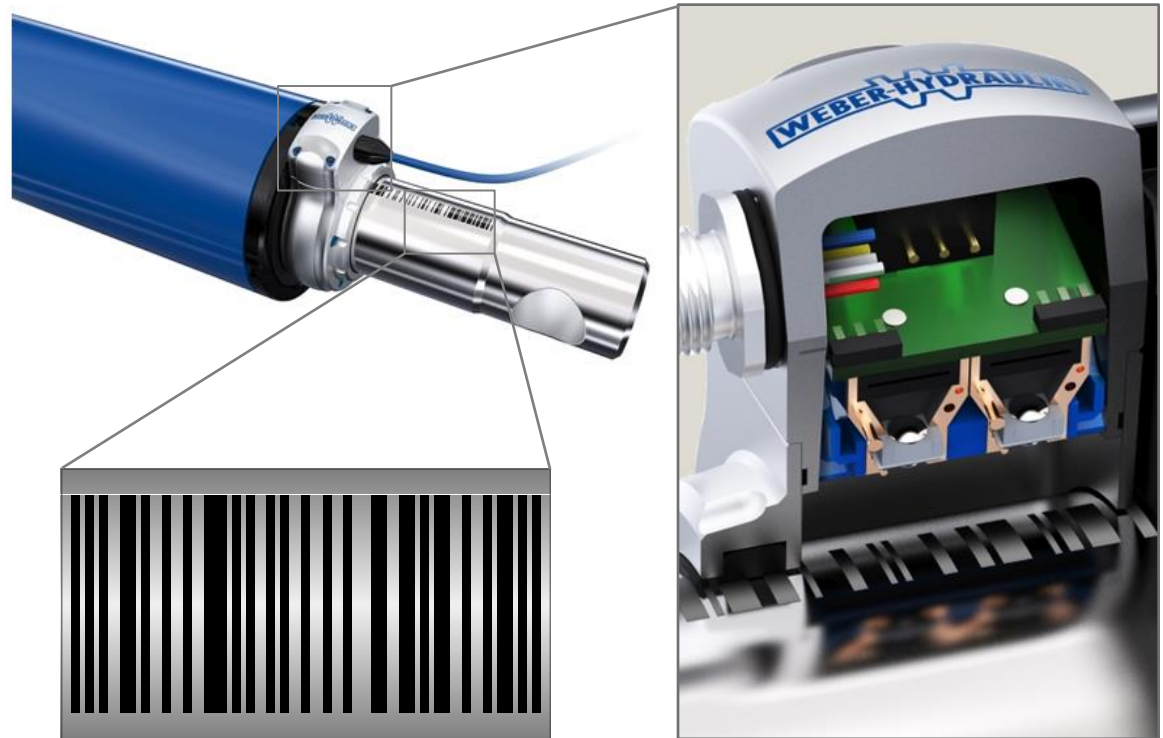


Source: Youtube

Safety in mobile crane application

Technology Push

- » Optical position sensing system
 - › Absolute measurement of the cylinder position
 - › Redundant system

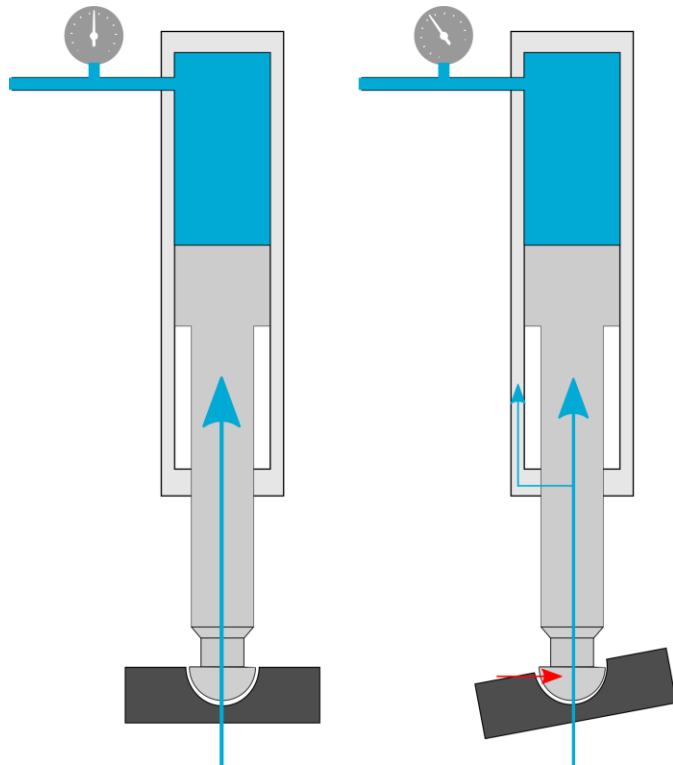


Source: MTS, SIKO, Festo

Safety in mobile crane application

Technology Push

- » Integrated force measurement system
 - › Compensating lateral forces to achieve higher precision
 - › Mechanical decoupling of the force transducer in retracted position



Special design of the load cell

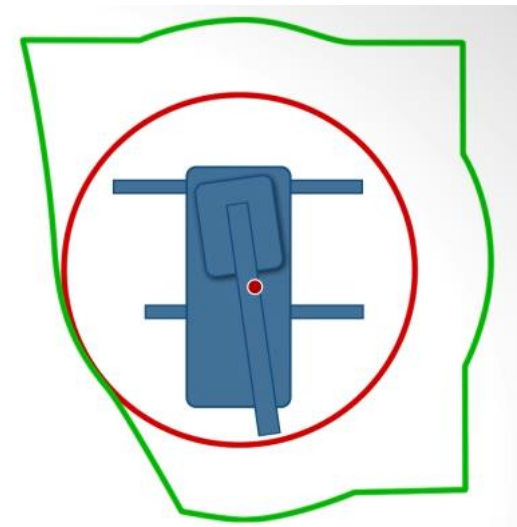
Detached ball head

- Coupling under compression force
- Decoupling under tensile force



Safety in mobile crane application

- » Online measurement the supporting force & position of supporting legs
- » Assessment of the stability of crane based on supporting & operational condition



- Conventional safe operation area
- Extended safe operation area with smart assessment system

Availability through remote diagnostics

Market Pull

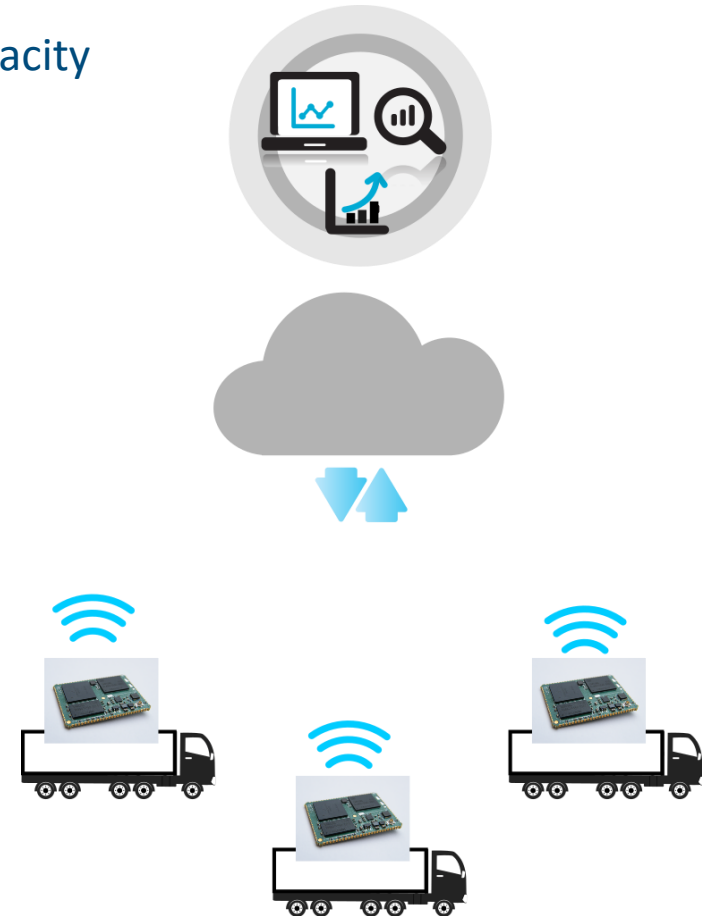
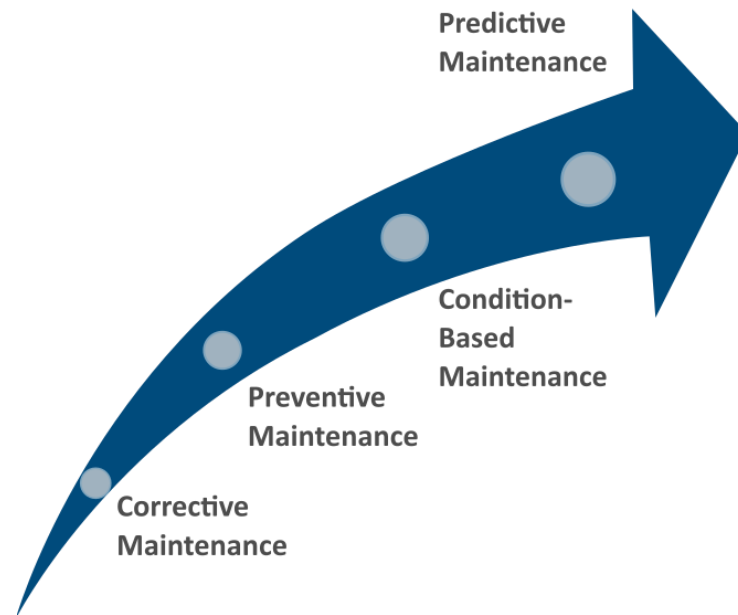
- » Reducing downtime and late delivery
- » Increasing fleet efficiency through higher availability



Availability through remote diagnostics

Technology Push

- » New trends in maintenance strategies
- » Connectivity and higher cloud storage/computing capacity



Availability through remote diagnostics

- » Remote diagnostics using online data
- » Prediction of the failure and the root causes



Summary

- » Mega trends shape the requirements and generate new opportunities
- » New requirements and emerging technologies arose from trends are the driver for intelligent hydraulics
- » More electronics are integrated into hydraulic system
- » Intelligent hydraulics provides added value in form of new features or resolving problems
- » Exemplary application of smart system illustrated how they fulfill growing requirements for safety and maintenance
- » Intelligent hydraulic systems are beneficial not only for customer but also for manufacturer

Vielen Dank für Ihre Aufmerksamkeit!



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