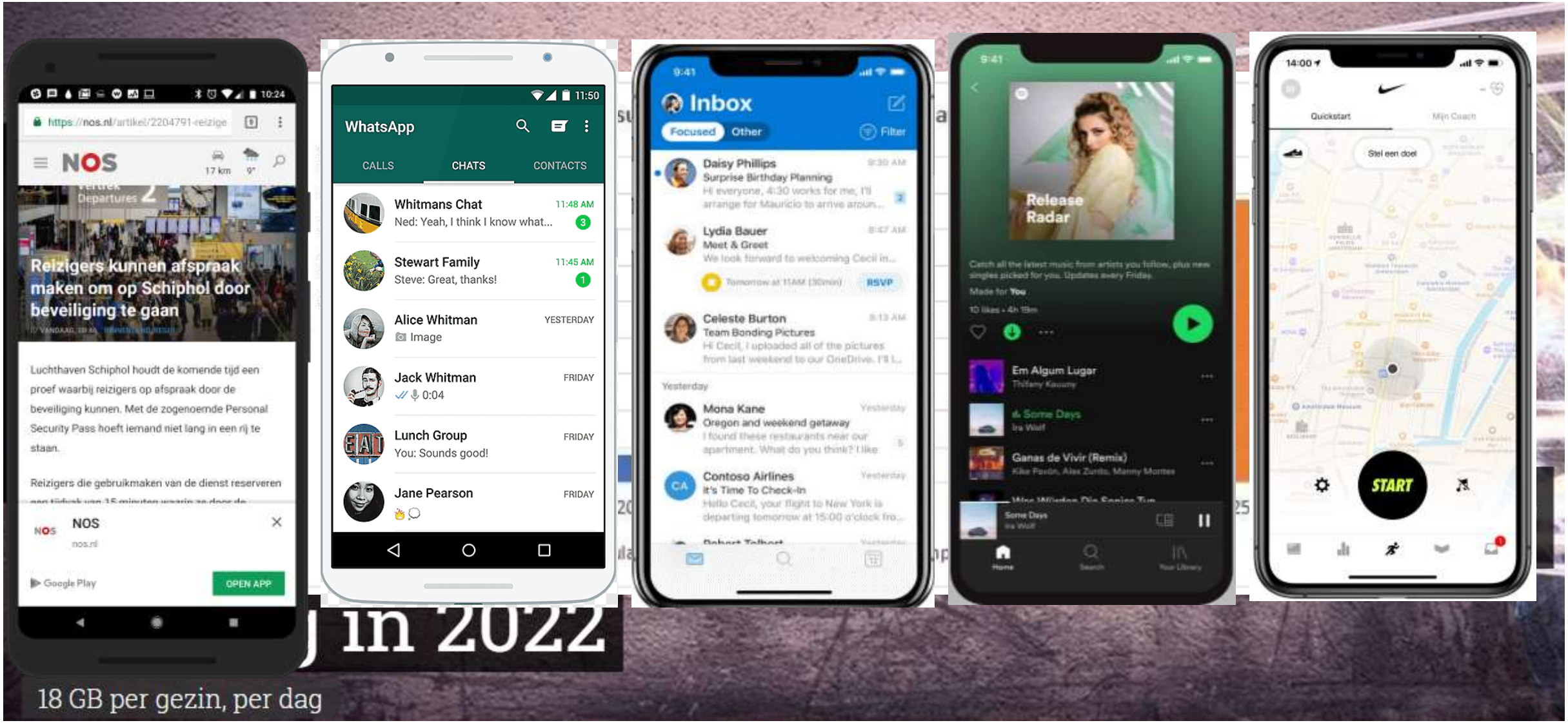
Novotek

Van PLC naar PowerBI
aan de hand van open standaarden

Agenda

1. Data ontsluiten — OPC UA
2. Data organiseren — UNS
3. Data transporteren — MQTT

Dataconsumptie in het algemeen



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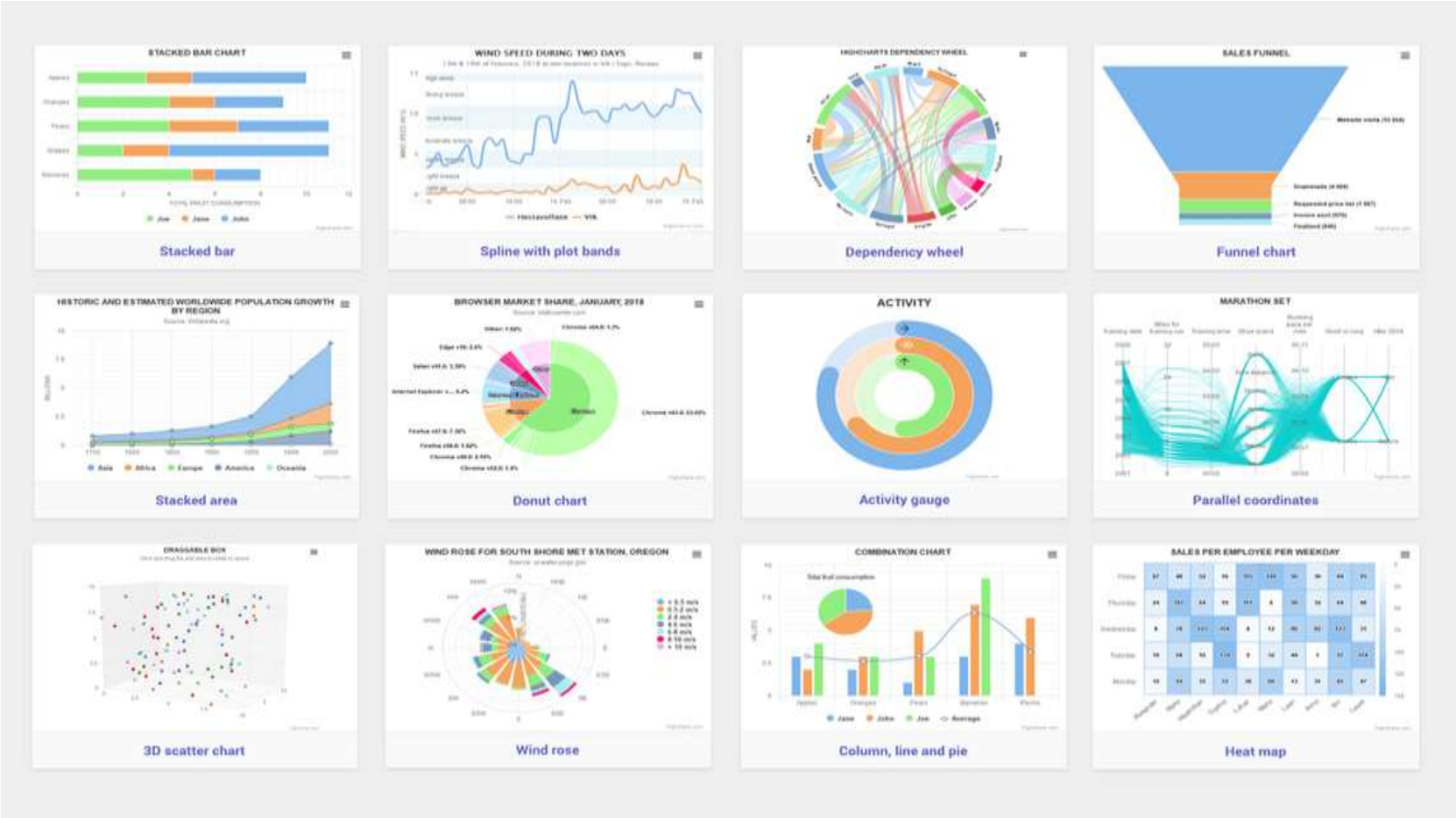
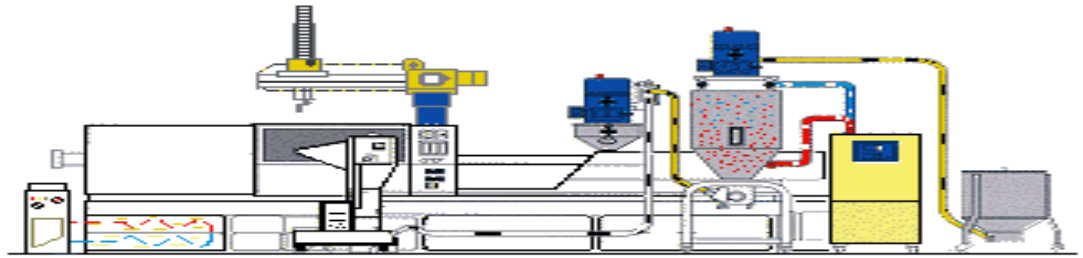

STACKED BAR CHART
Stacked bar
WIND SPEED DURING TWO DAYS
Spline with plot bands
HIGHCHARTS DEPENDENCY WHEEL
Dependency wheel
SALES FUNNEL
Funnel chart
HISTORIC AND ESTIMATED WORLDWIDE POPULATION GROWTH BY REGION
Stacked area
BROWSER MARKET SHARE, JANUARY, 2018
Donut chart
ACTIVITY
Activity gauge
MARATHON SET
Parallel coordinates
DRAGGABLE BOX
3D scatter chart
WIND ROSE FOR SOUTH SHORE MET STATION, OREGON
Wind rose
COMBINATION CHART
Column, line and pie
SALES PER EMPLOYEE PER WEEKDAY
Heat map



PLC

- Time based
- Tag based
- Heel veel data
- Complex adressering

PowerBI

- Event based
- Object oriented
- Weinig data
- Logical address space

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Data Transfereren

Package A

Package B

MQTT

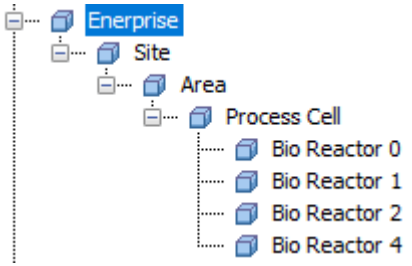
Data Organiseren

Object1

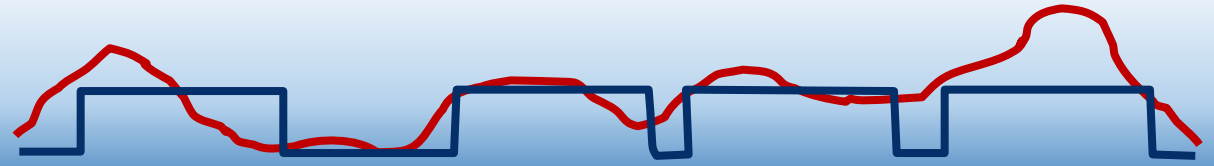
Object2

Object3

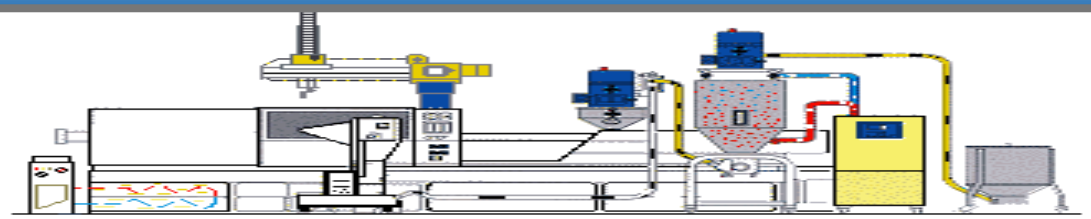
Object4



Data Ontsluiten



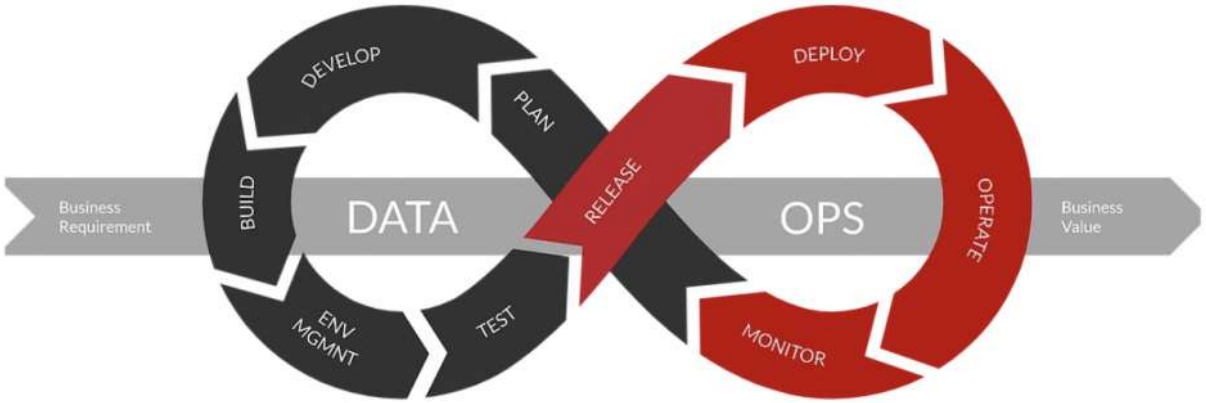
OPC UA



What is DataOps?

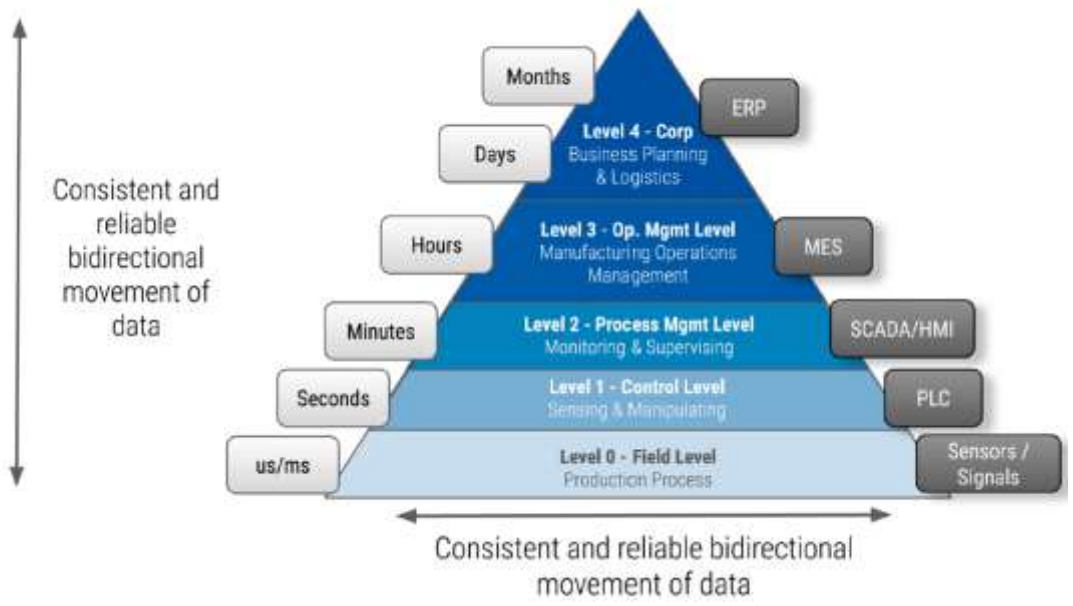
Data Operations

Ensure that **value** is delivered to the business as soon as possible

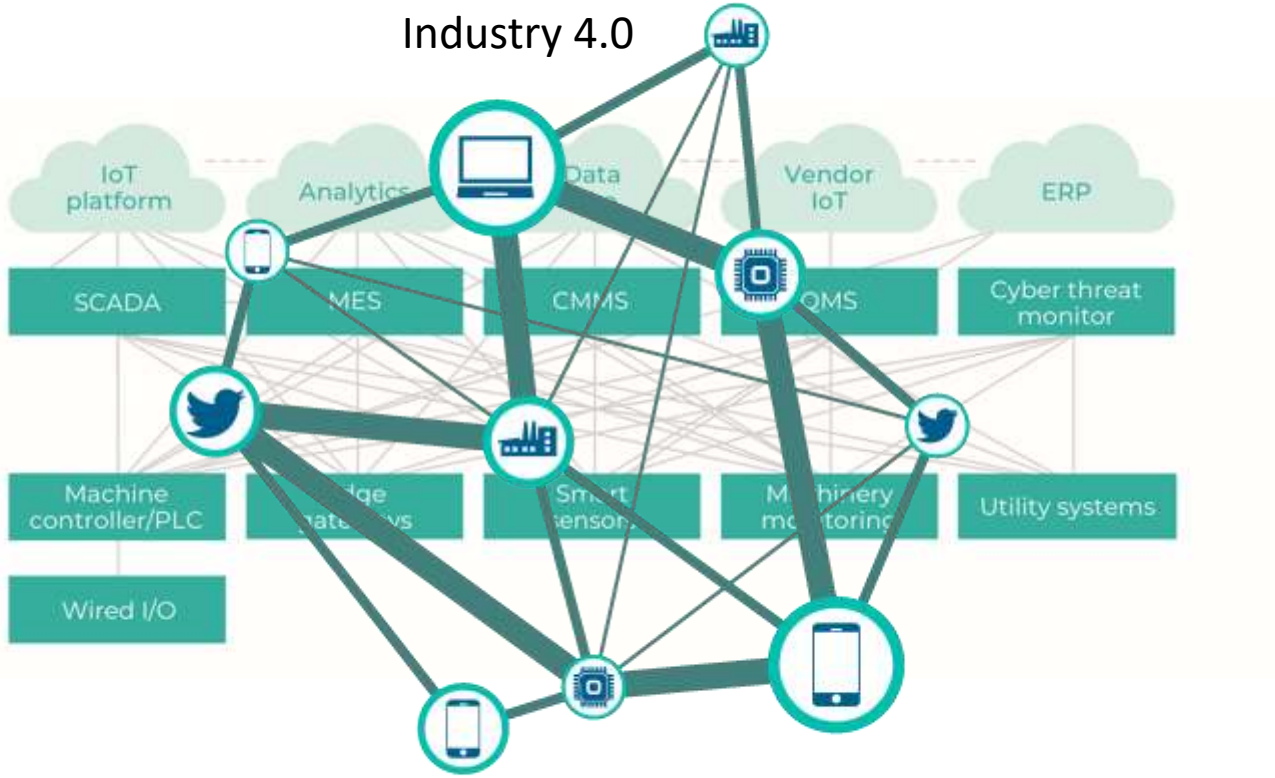


Manufacturing's technology landscape has changed

Industry 3.0



Industry 4.0



Data challenges are threatening Industry 4.0 success

IT systems using industrial data are not scaling

Custom scripts are slowing integration time and creating technical debt

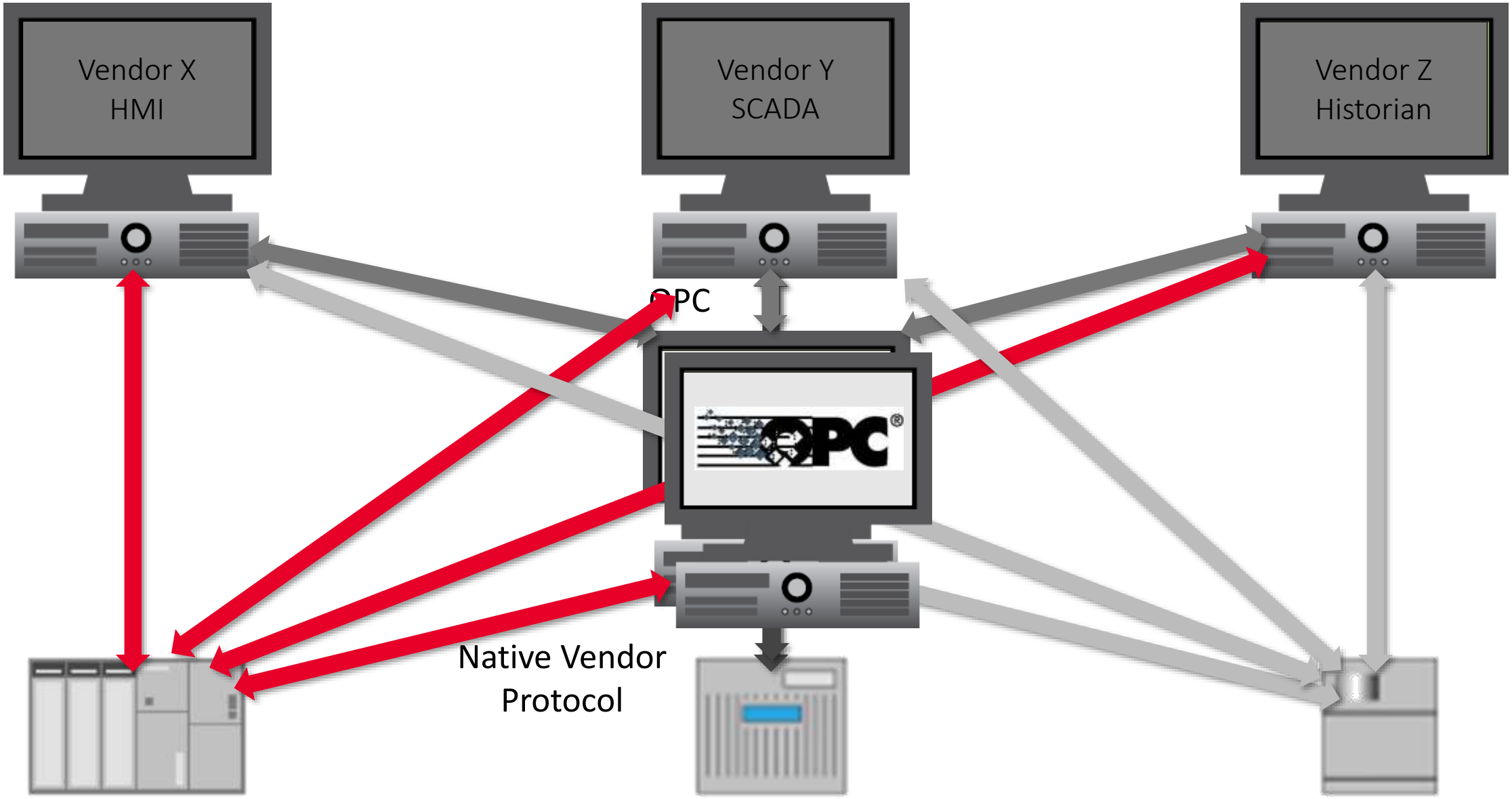
Data science is spending 80% of time finding and preparing data for analytics

IT is paying high, variable cloud storage and processing fees for unusable data

OT is backlogged with requests to grant access to and explain machine data

Security is unknown

Data Ontsluiten


Vendor X
HMI
Vendor Y
SCADA
Vendor Z
Historian
OPC
Native Vendor
Protocol

OPC Standaard

- Open Platform Communications
- Opgericht in 1995
- OPC Classic (DA, HDA, A&E)
  - Microsoft COM/DCOM
- OPC UA
  - Platform onafhankelijk
  - Object georienteerd
  - Binair/XML
  - Encryption

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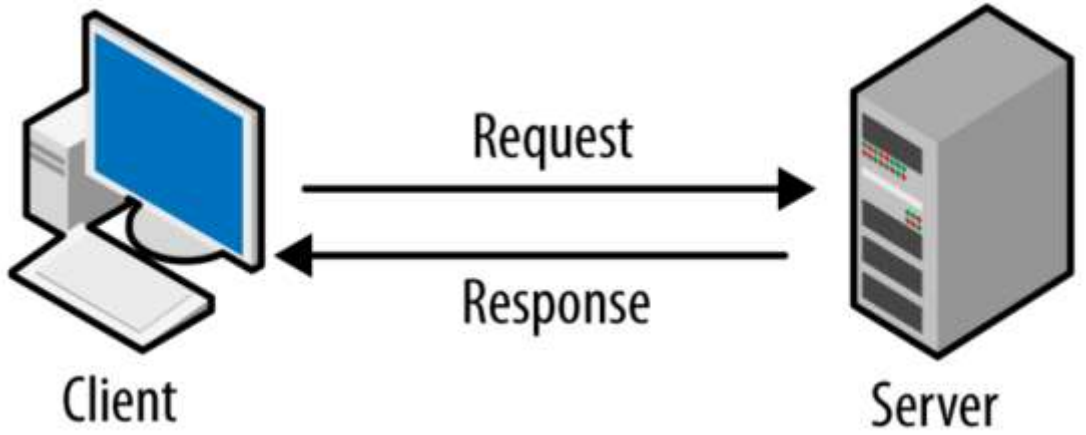
Basics of Client/Server Technology



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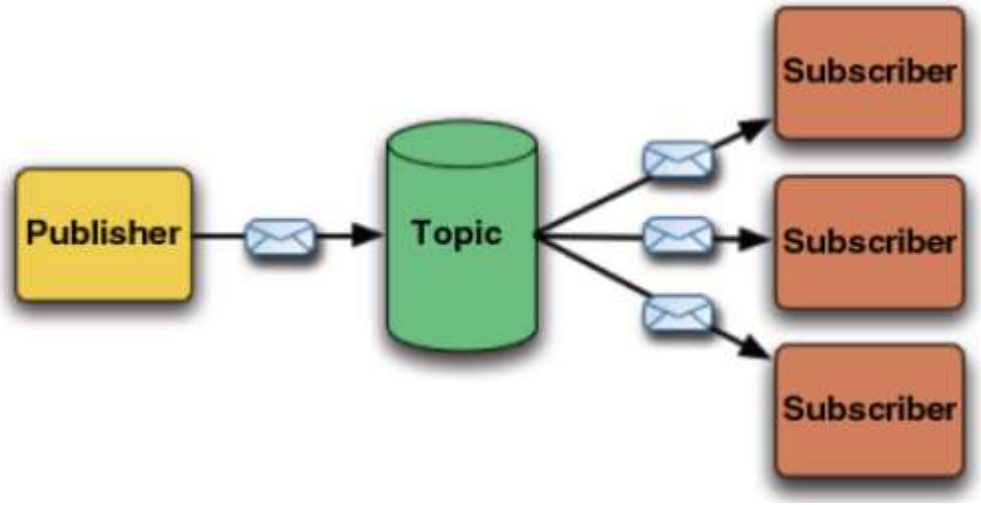
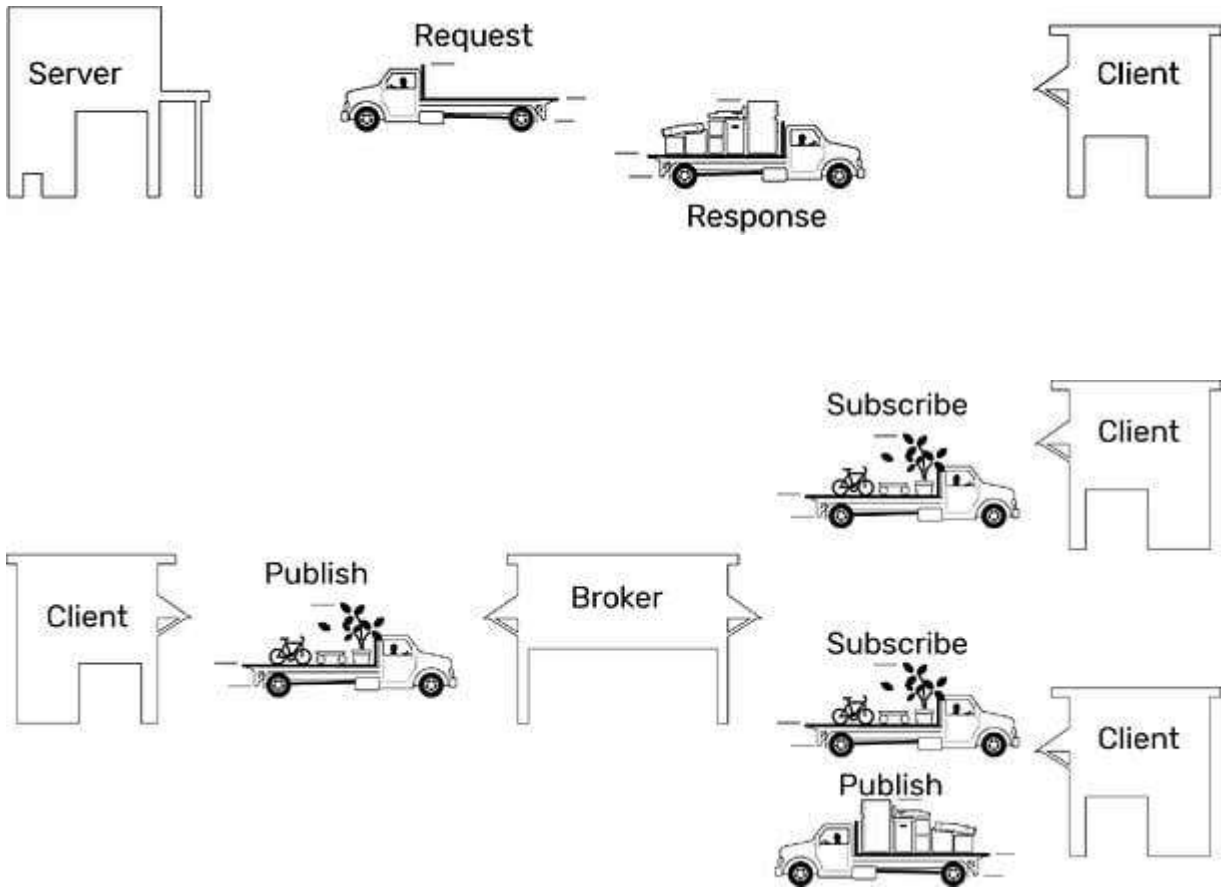
Basics of Pub/Sub Technology



Client/Server vs Pub/Sub



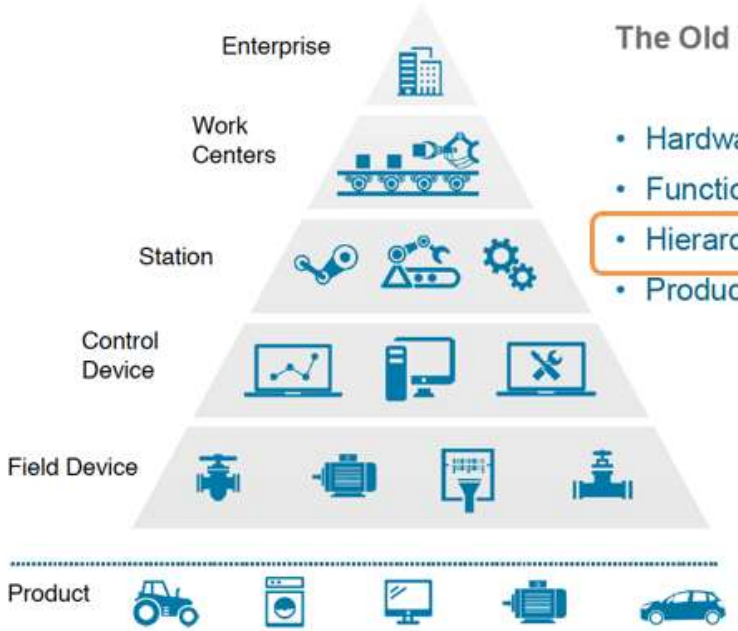
Client/Server

- Session based
- Client specific
- Synchronous
- High bandwidth
- One-to-one

Pub/Sub

- No session management
- Multi-cast
- Asynchronous
- Low bandwidth
- One-to-many

PubSub Scenario: Smart Manufacturing



Client / Server

The Old World: Industrie 3.0

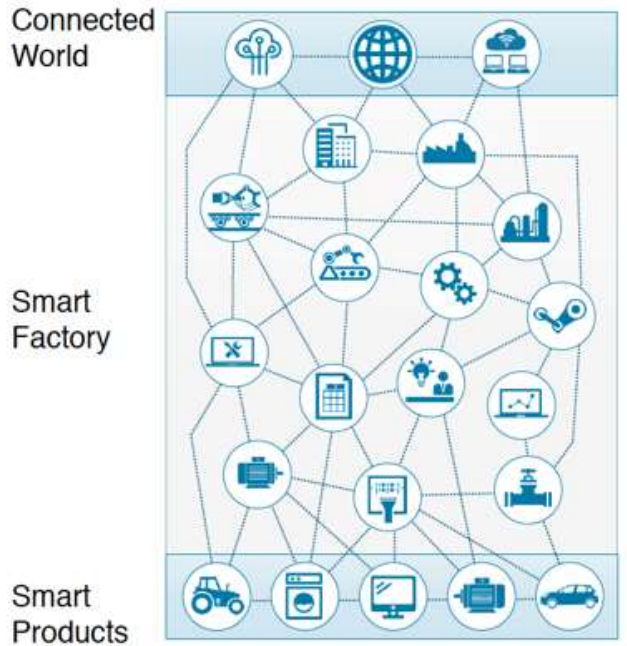
- Hardware-based structure
- Functions are bound to hardware
- Hierarchy-based communication
- Product is isolated

The New World: Industrie 4.0

- Flexible systems and machines
- Functions are distributed throughout the network
- Participants interact across hierarchy levels
- Communication among all participants
- Product is part of the network

(Martin Hankel, Plattform Industrie 4.0 / Graphics © Anna Salari, designed by freepik)

Publisher/Subscriber



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Power BI

Data Transfereren

Package A

Package B

MQTT

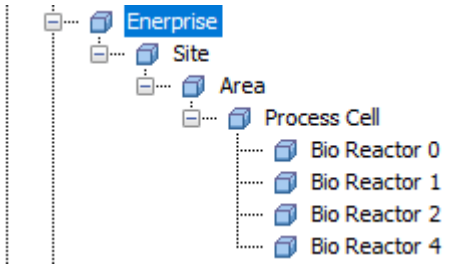
Data Organiseren

Object1

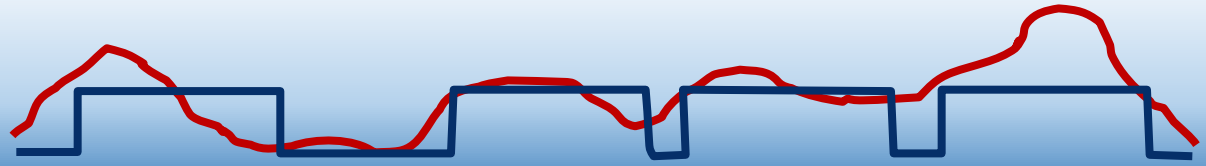
Object2

Object3

Object4

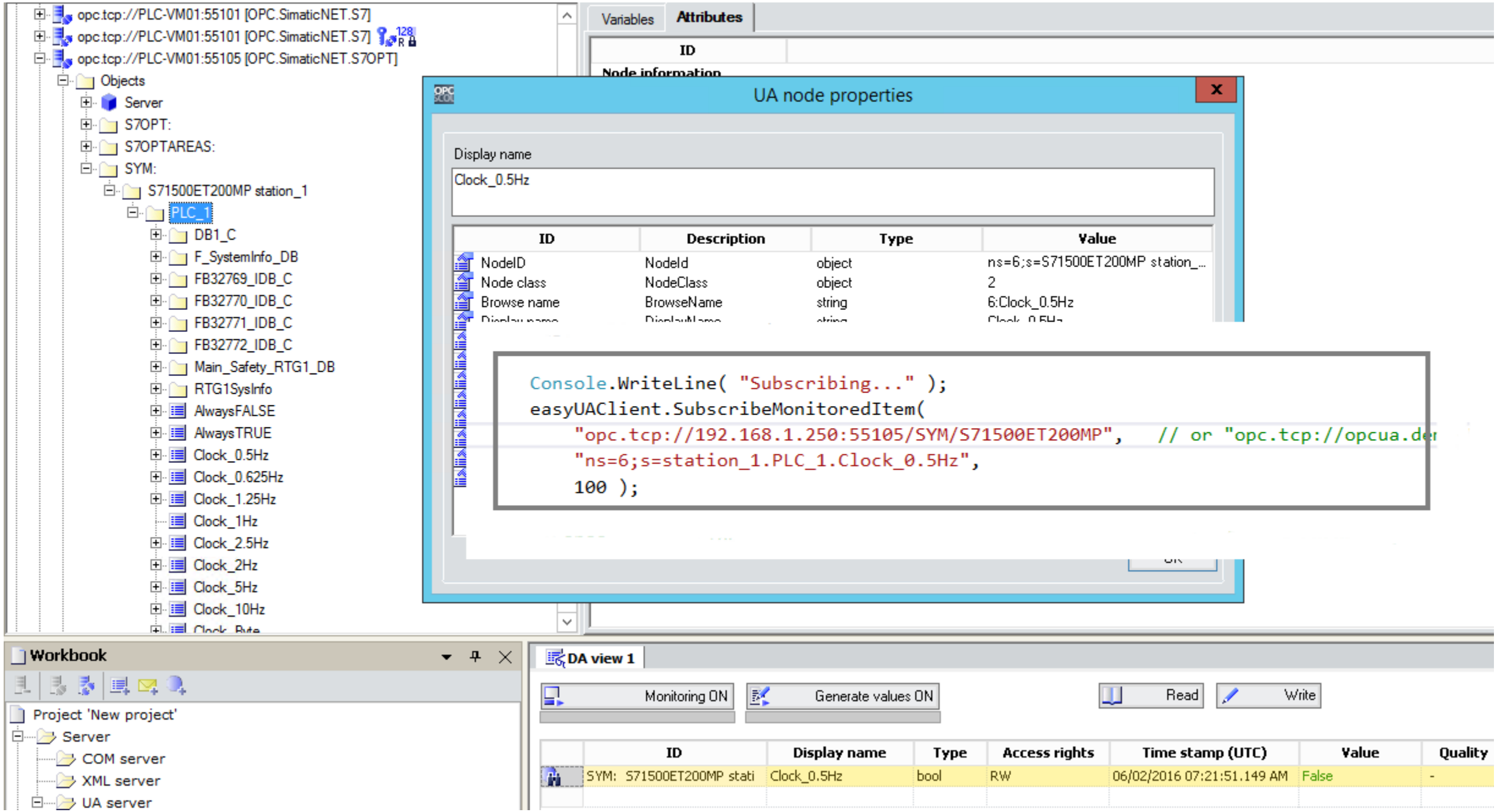


Data Ontsluiten

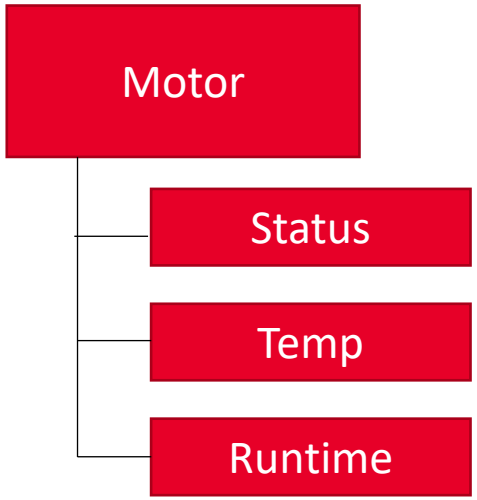


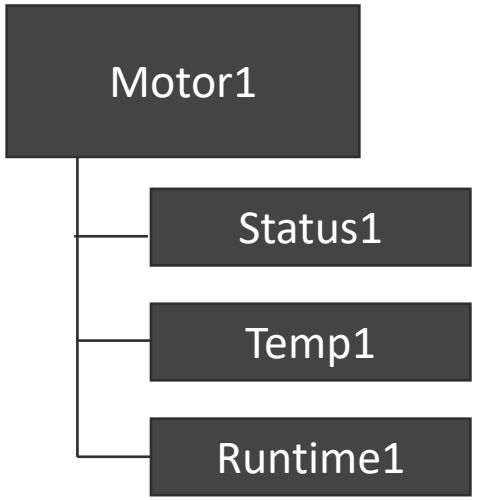
OPC UA

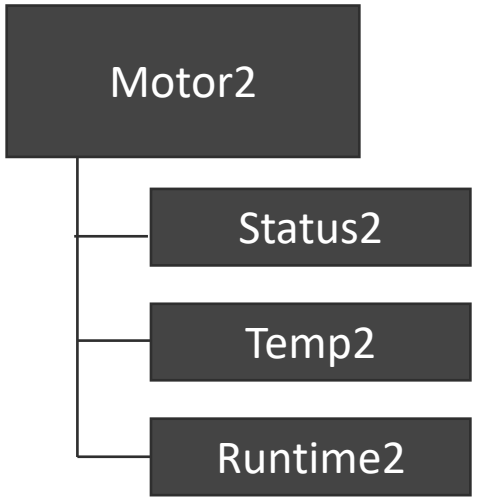
Data Organiseren


opc.tcp://PLC-VM01:55101 [OPC.SimaticNET.S7]
opc.tcp://PLC-VM01:55101 [OPC.SimaticNET.S7]
opc.tcp://PLC-VM01:55105 [OPC.SimaticNET.S7OPT]
Objects
Server
S7OPT:
S7OPTAREAS:
SYM:
S71500ET200MP station_1
PLC_1
DB1_C
F_SystemInfo_DB
FB32769_IDB_C
FB32770_IDB_C
FB32771_IDB_C
FB32772_IDB_C
Main_Safety_RTG1_DB
RTG1SysInfo
AlwaysFALSE
AlwaysTRUE
Clock_0.5Hz
Clock_0.625Hz
Clock_1.25Hz
Clock_1Hz
Clock_2.5Hz
Clock_2Hz
Clock_5Hz
Clock_10Hz
Variables
Attributes
ID
Node information
UA node properties
Display name
Clock_0.5Hz
ID
Description
Type
Value
NodeID
NodeId
object
ns=6;s=S71500ET200MP station_...
Node class
NodeClass
object
2
Browse name
BrowseName
string
6:Clock_0.5Hz
Console.WriteLine("Subscribing...");
easyUAClient.SubscribeMonitoredItem(
"opc.tcp://192.168.1.250:55105/SYM/S71500ET200MP", // or "opc.tcp://opcua.de
"ns=6;s=station_1.PLC_1.Clock_0.5Hz",
100);
Workbook
Project 'New project'
Server
COM server
XML server
UA server
DA view 1
Monitoring ON
Generate values ON
Read
Write
ID
Display name
Type
Access rights
Time stamp (UTC)
Value
Quality
SYM: S71500ET200MP stati
Clock_0.5Hz
bool
RW
06/02/2016 07:21:51.149 AM
False
-

Object Oriented Approach





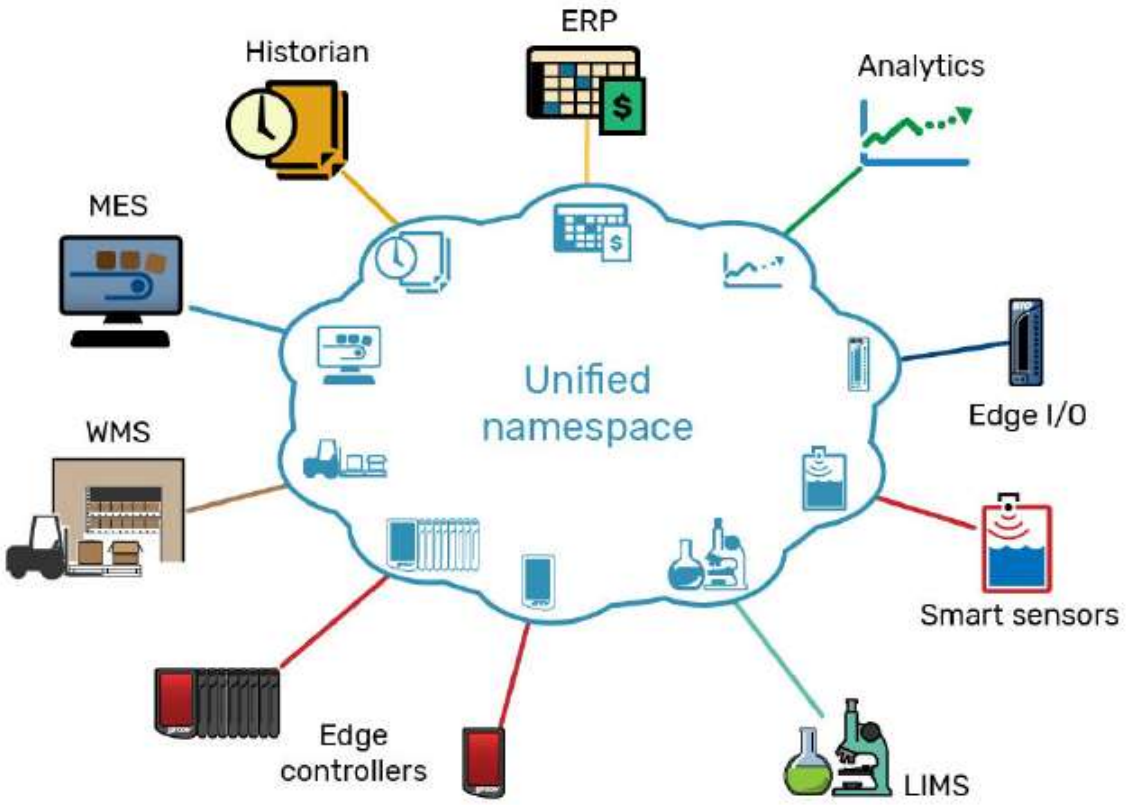


UNS = Unified Name Space

"Consolidated, abstracted structure by which business and industrial applications can exchange industrial data"

- Standardized
- Normalized
- Contextualized
- Consolidated

Unified Namespace approach



- A referenced Data Hub for both OT and IT
- Where **all** applications are able to communicate real-time industrial data in a consistent manner
- Where data becomes logical and source - format agnostic, approachable on request by topic name
- Scaleable
- Agile
- Open yet Secure

UNS Example

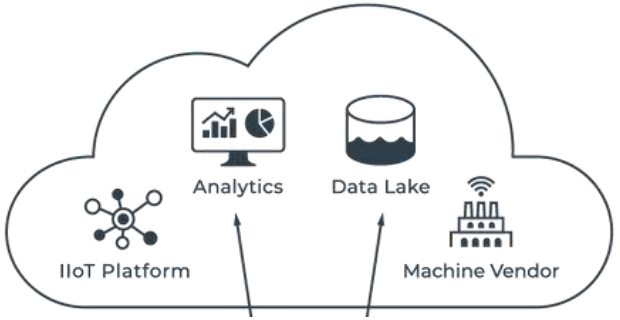
- **Site**
  - Name
- **Line**
  - OEE
  - Lot data
  - Electronic Batch Records
- **Unit**
  - Compliance
  - Quality
- **Asset**
  - Temperature
  - Humidity

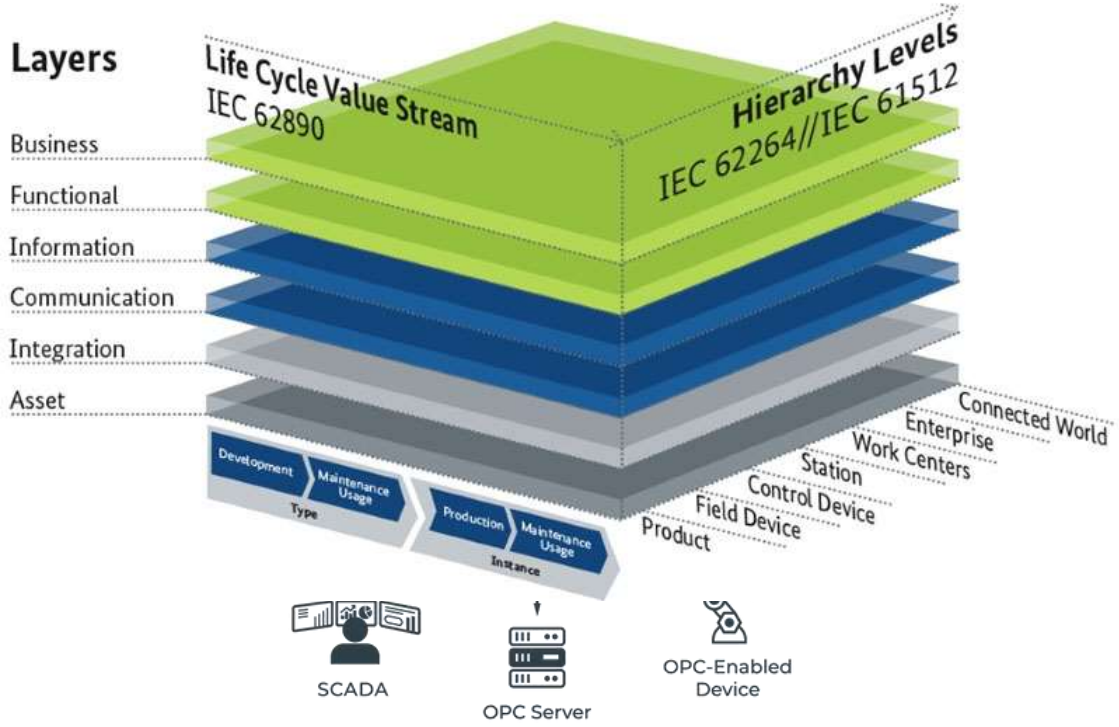
JSON message


```
{
 “_name" : “MK3BatchReport",
 “_model" : “BatchReport",
 “_timestamp" : 1588025745589,
"Factory" : "Paine Factory - Portland Maine",
“Line" : “CellLine2”,
“Phase" : “Growth”,
“MasterRecipe" : “YUM55345”,
“Customer" : “ACME BioHealth”,
“TankTemperatureC_Avg" : 36.550,
“TankTemperatureC_Max" : 37.250,
“Base” : 126.54
“BaseAdded” : .54
“QualityMetric" : “PASS",
 “BGA” : {
   “pH_OI" : “7.50”,
   “PHOffline” : 7.56,
   “pCO2” : 25.2,
   },
 “BioHT“ :{
   ”Glucose" : 4.62,
   “Glutamine” : 3.2
   “Lactate” : .28,
   “Amonia” : 2.63
   “AgitPV" : “200",
   }
}
```

UNS Options

- OPC Standard
- MES System
- Industrie 4.0 RAMI
- Dedicated UNS





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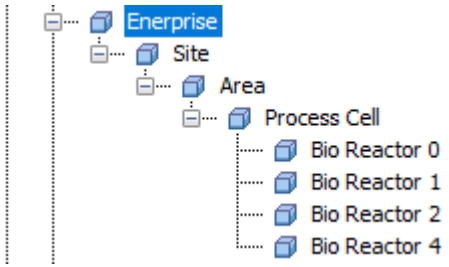
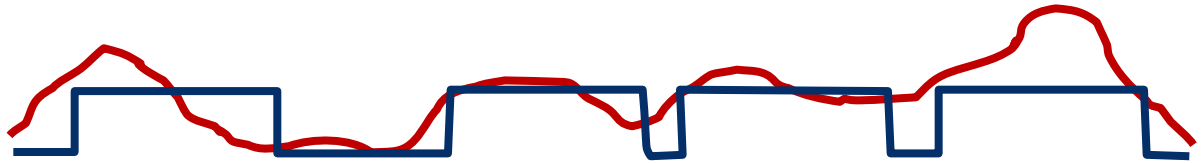


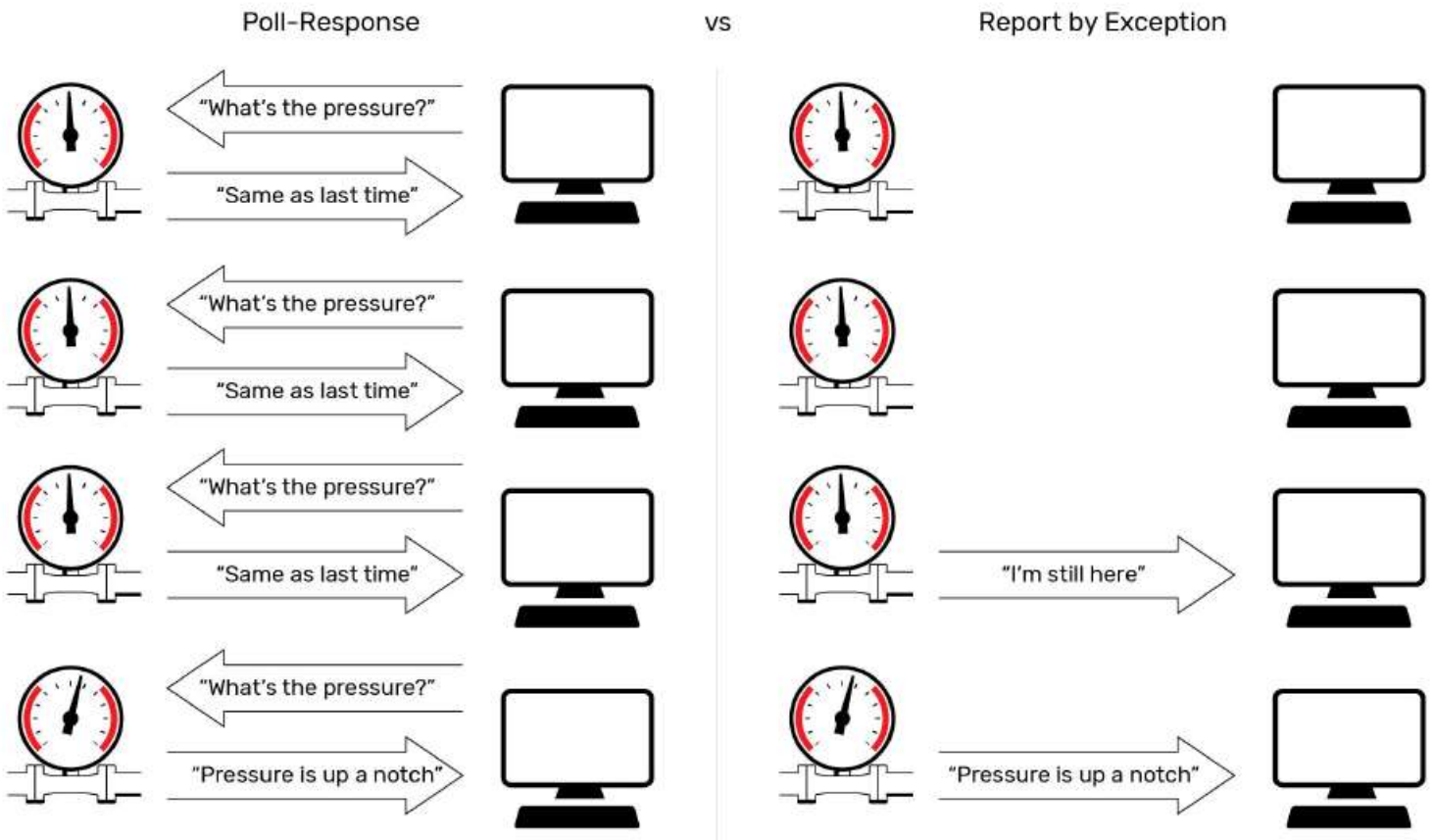
Data Ontsluiten



OPC UA

Data Transporteren

Data communication



First we had
Internet of People

Then came
Internet of Things

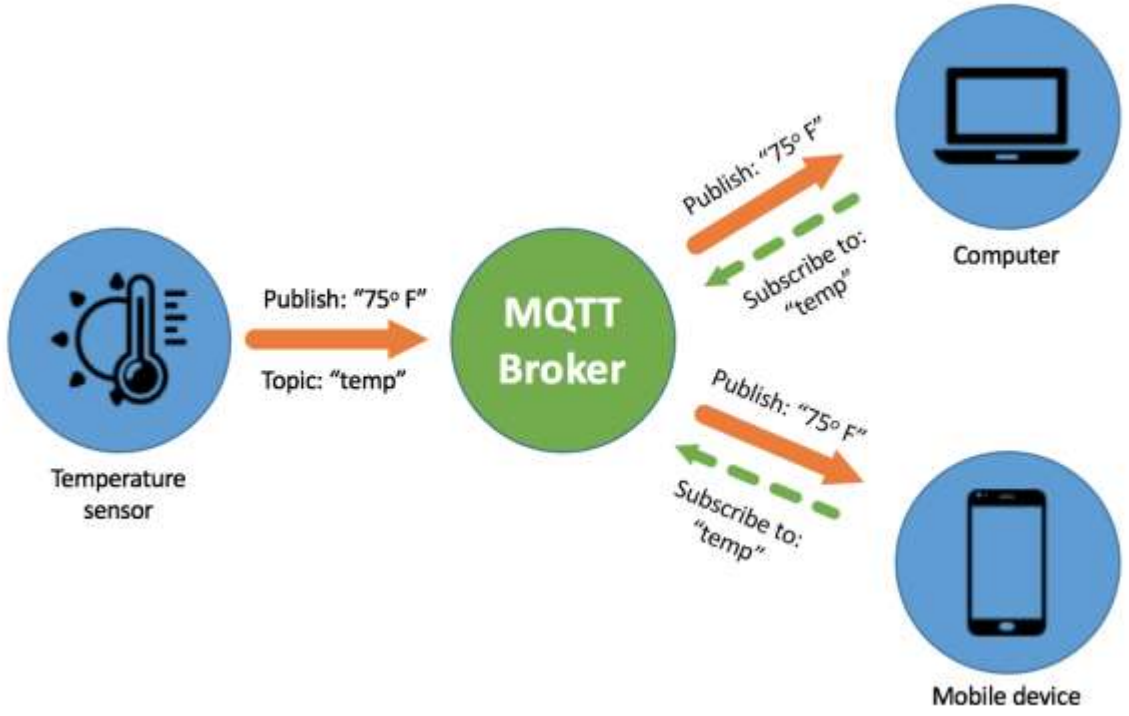
Now we have
Industrial Internet of Things

HTTP:// → MQTT → MQTT

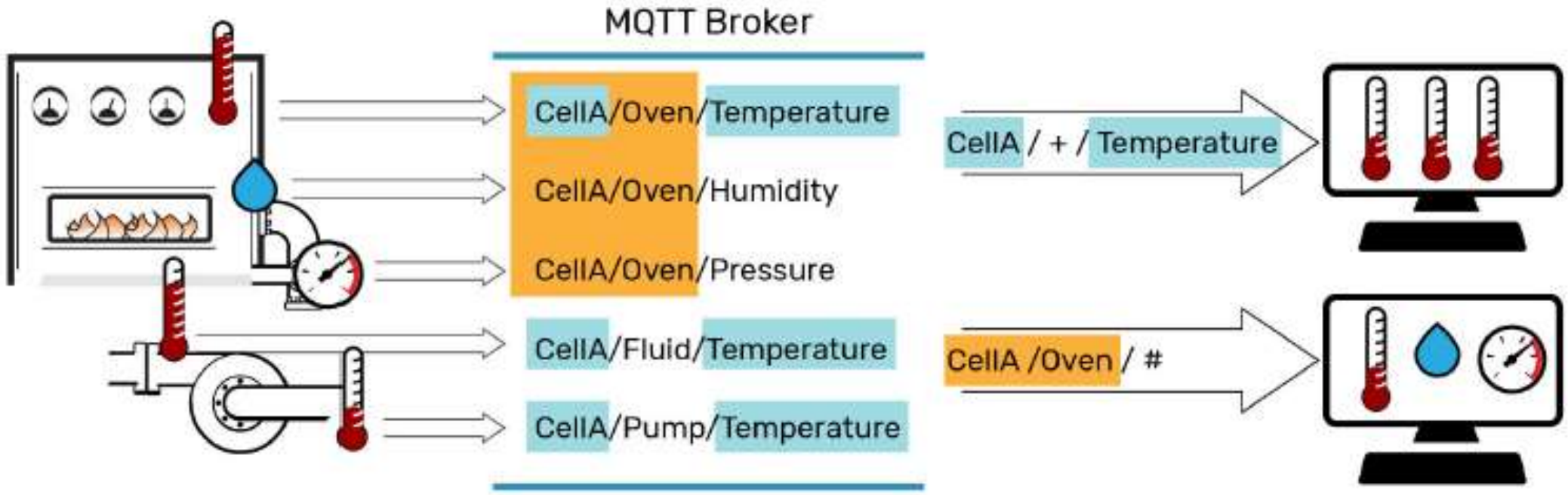
HTML → Sparkplug

MQTT

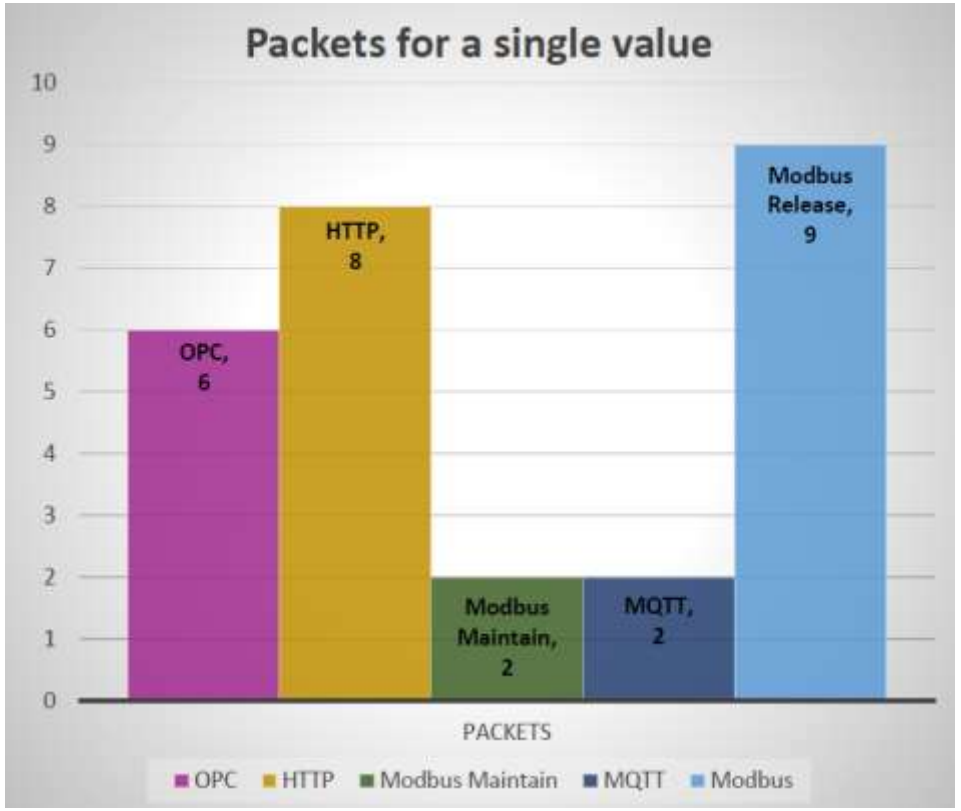
- A lightweight network protocol
- Hub = Broker / Spoke = Client
- Data subject = Topic
- Data content = Payload
- Publish & Subscribe
- Data format agnostic
- Quality of Service
- TSL security

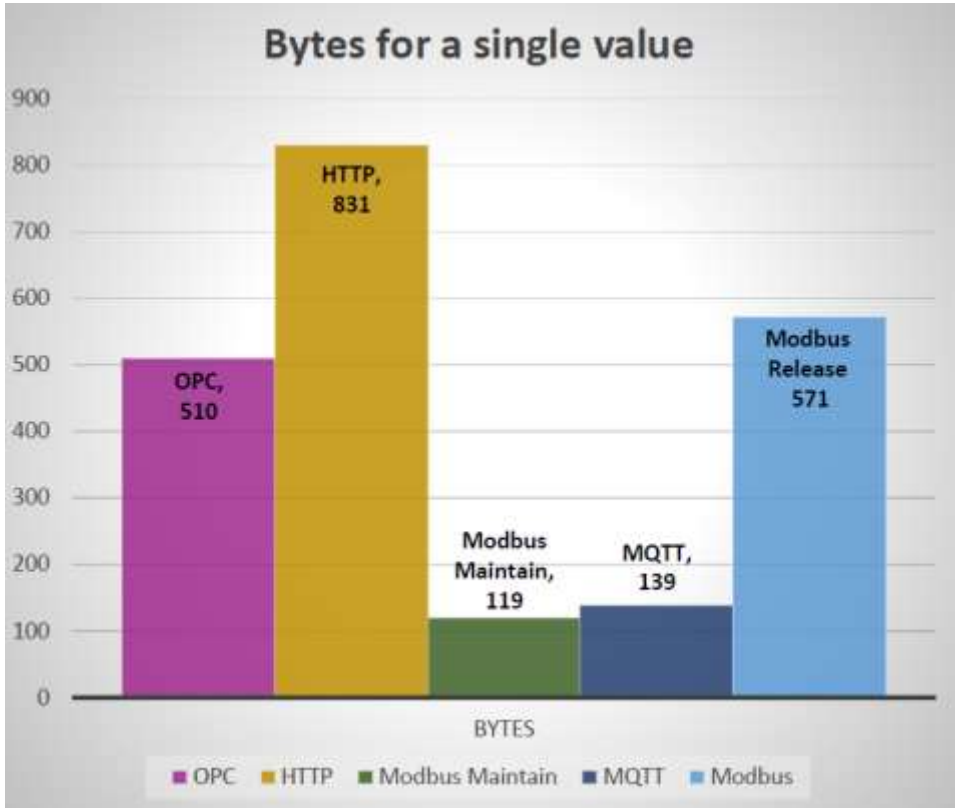


Example


MQTT Broker
CellA/Oven/Temperature
CellA/Oven/Humidity
CellA/Oven/Pressure
CellA/Fluid/Temperature
CellA/Pump/Temperature
CellA / + / Temperature
CellA /Oven / #

MQTT benchmark





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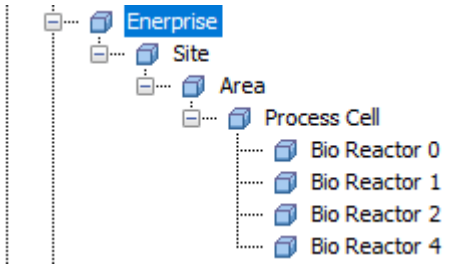

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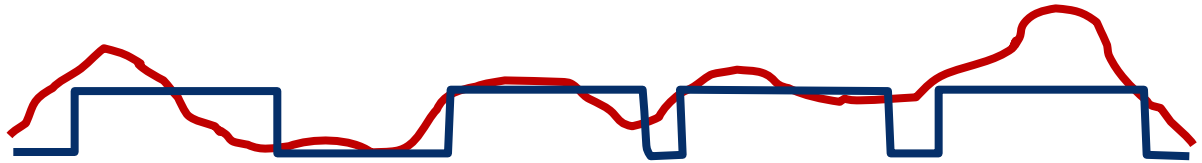
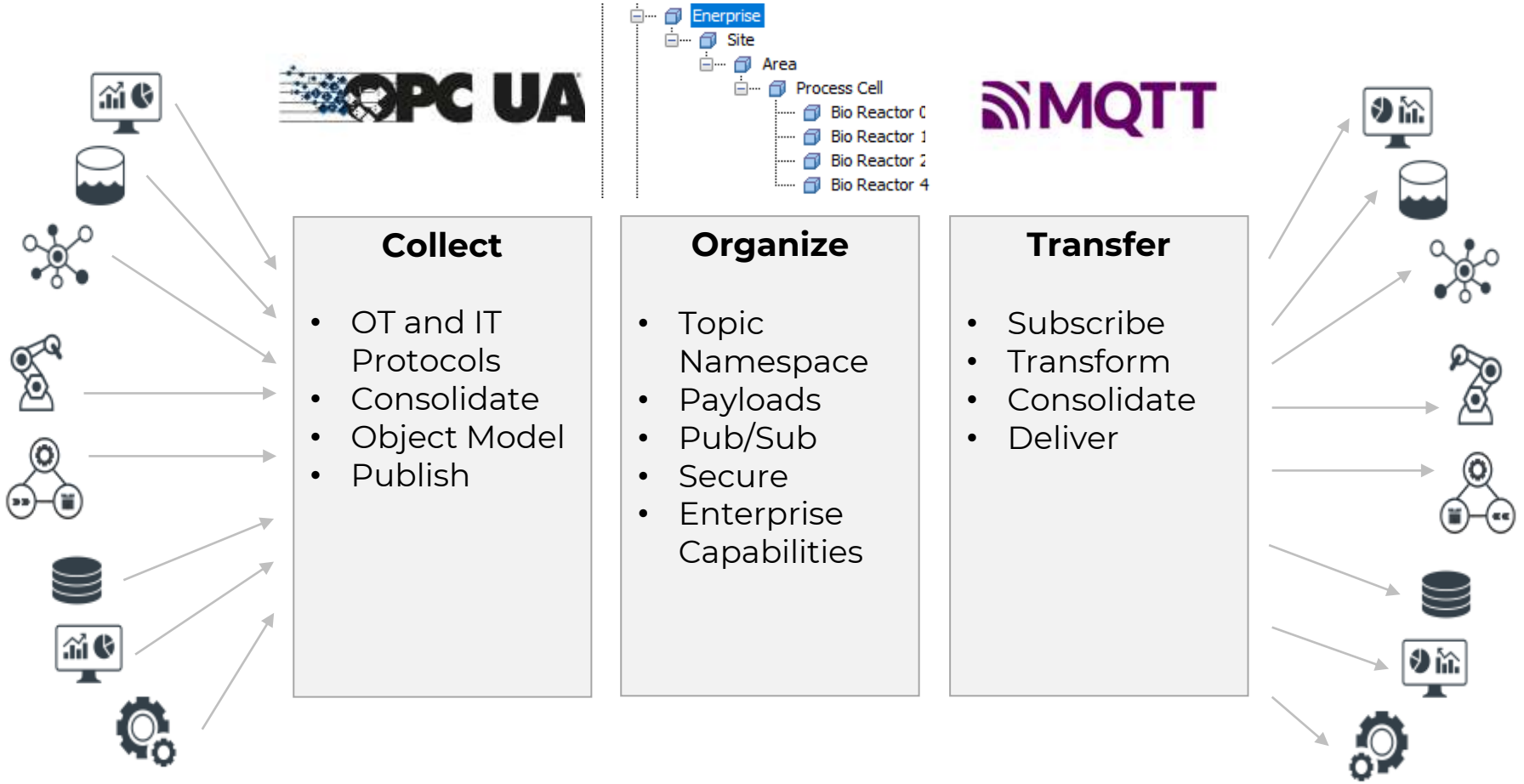


OPC UA

OT – IT Reference Architecture



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Bedankt voor uw aandacht