



## Are PLM software soon to be dinosaurs ?

International PLM conference  
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Digital Design Manufacturing & Services roadmap lead

# Airbus today



## Every day...

<p><b>6 MILLION</b> Passengers fly in an <b>AIRBUS AIRCRAFT</b></p>	<p>Airbus aircraft serve <b>1,500 AIRPORTS</b> in over 180 Countries and Territories</p>
<p>An Airbus aircraft takes off or lands every <b>1.2 SECONDS</b></p>	<p>Airbus aircraft fly over <b>80,000 FLIGHT HOURS</b></p>
<p><b>2,466 PATIENTS ARE TREATED</b> thanks to an Airbus helicopter rescue</p>	<p>Airbus aircraft fly <b>65 Million km</b> <b>1,600 TIMES ROUND THE GLOBE</b></p>



IN € MILLION		FY 2018
Order Intake (net)	Units	747
Order Book		7,577
Order Intake (net)	Value	41,519
Order Book		411,659
Deliveries (units)		800
Revenues		47,970
R&D Expenses		2,214
<i>in % of Revenues</i>		4.6%
EBIT Adjusted		4,808
<i>in % of Revenues</i>		10.0%
EBIT		4,295
<i>in % of Revenues</i>		9.0%



# What do these pioneers realize ? Ho long did this transformation take ?

1960



1967 : 1<sup>st</sup> flight Boeing 737  
1969 : 1<sup>st</sup> flight Boeing 747  
1<sup>st</sup> flight Concorde



**~45 years**



2005



1987 : 1<sup>st</sup> flight A320  
2005 : 1<sup>st</sup> flight A380

**PDM**

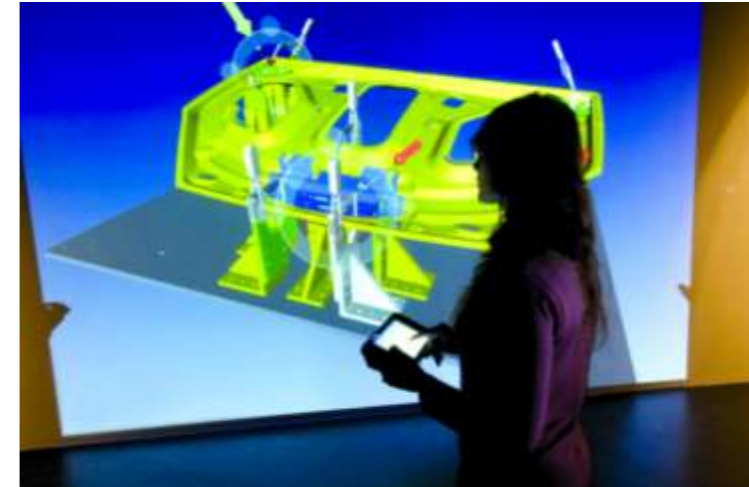
# What about the next one ?

2005



2005 : 1<sup>st</sup> flight A380

2018



2013 : 1<sup>st</sup> flight A350 -900

2016 : Solar Impulse world tour

2018 : Space X Boosters ground landing

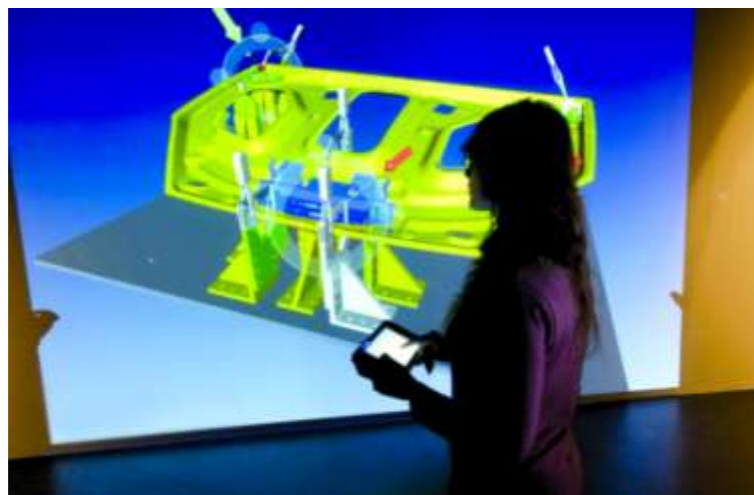


**12 years**



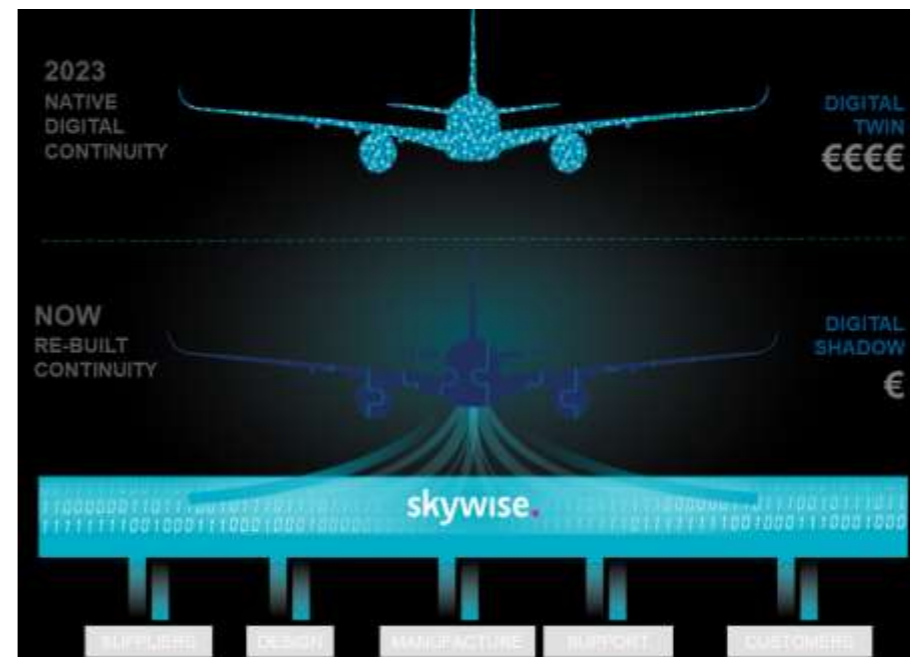
PLM

# Our next breakthrough to create the future ?



- 2013 : 1<sup>st</sup> flight A350 -900
- 2016 : Solar Impulse world tour
- 2018 : Space X Boosters ground landing

## 5 years ?



???

New single aisle  
to be launched in the next decade,  
and digital is new name of the game

# PLM has become the skeleton around which collaborative networked design is being run...

## It needs to handle always more information than the core CAD PDM data it used to handle...

- Digital Mock-up was the original heart of the PDM, now completed by scores of other features
- More and more activity, process, contracts, cooperation rather than technical data
- Complexity & integration dramatically increased on Product, Processes, Extended enterprise...

## ... but it's key infrastructure & principles have not progressed so much...

- still often "a self-centered big software package"
- still mostly data repository centric
- still mostly classical configuration & access right management...
- still mostly explicit & fixed workflows
- still mostly relying on dedicated interfaces to connect to other systems



## ...leading to numerous concerns not being easy to fix today !

- performance
- scalability
- integration
- extended enterprise
- durability



# Let's see how enterprise platform emerging technologies could help fixing these issues...



Integration



Scalability



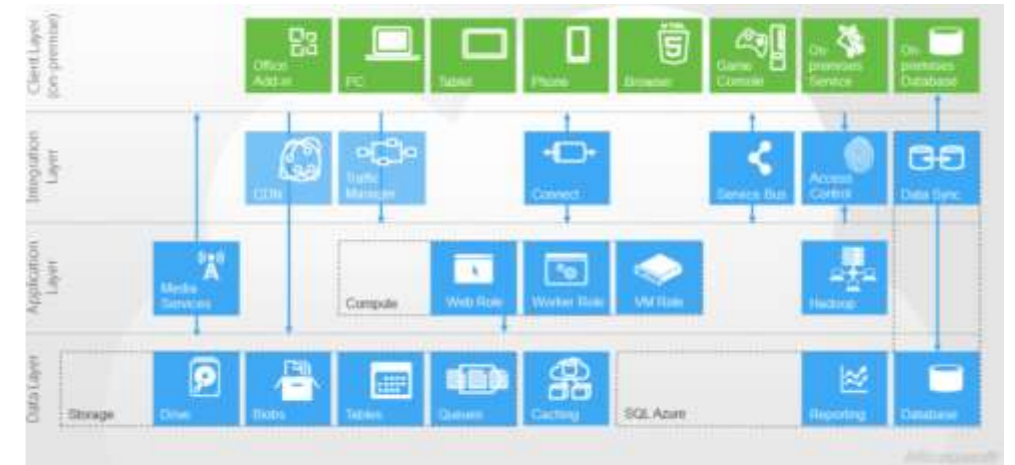
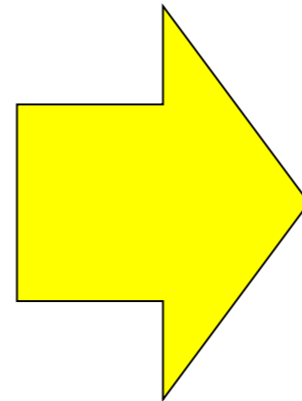
Performance



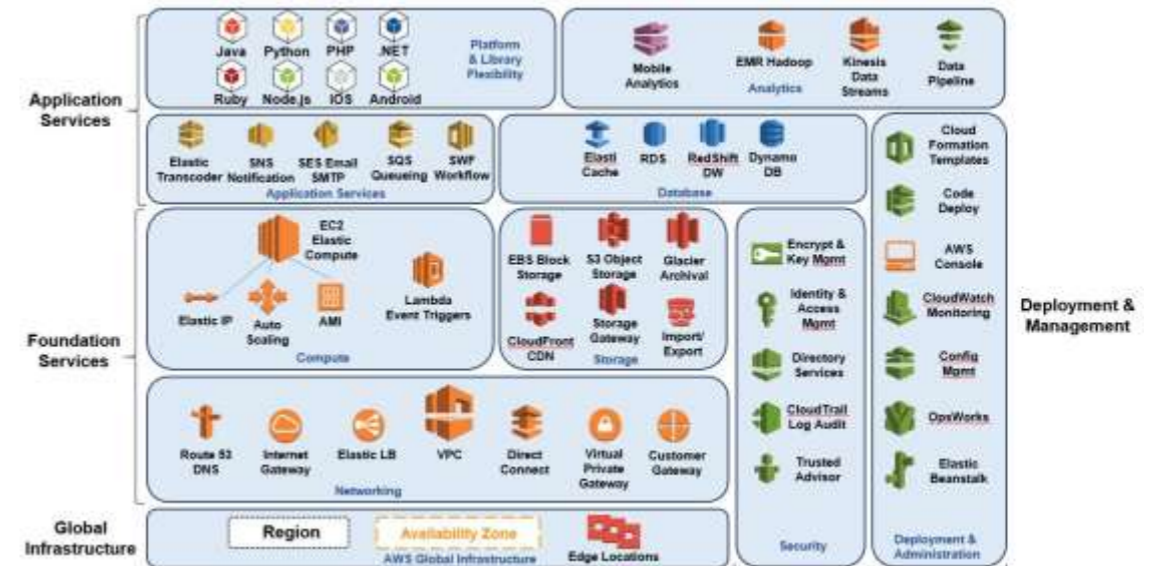
Durability



Extended enterprise



Microsoft Azure



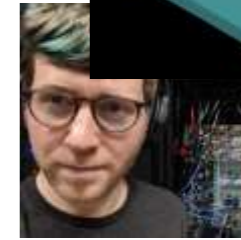
Amazon Web Services (AWS)

# Distributed filesystems e.g. Inter Planetary File System

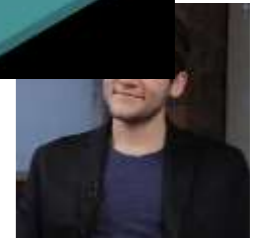
## What is IPFS ?

- Distributed hash tables providing decentralization, fault tolerance and scalability
- Block exchanges securing coordination of data transfers between millions of nodes
- Merkle tree securing exchanged blocks are uniquely identified, correct & unaltered
- Distributed version control system allowing access to past versions of edited data
- Self-certifying File System pre-authenticate & verify data using public key cryptography

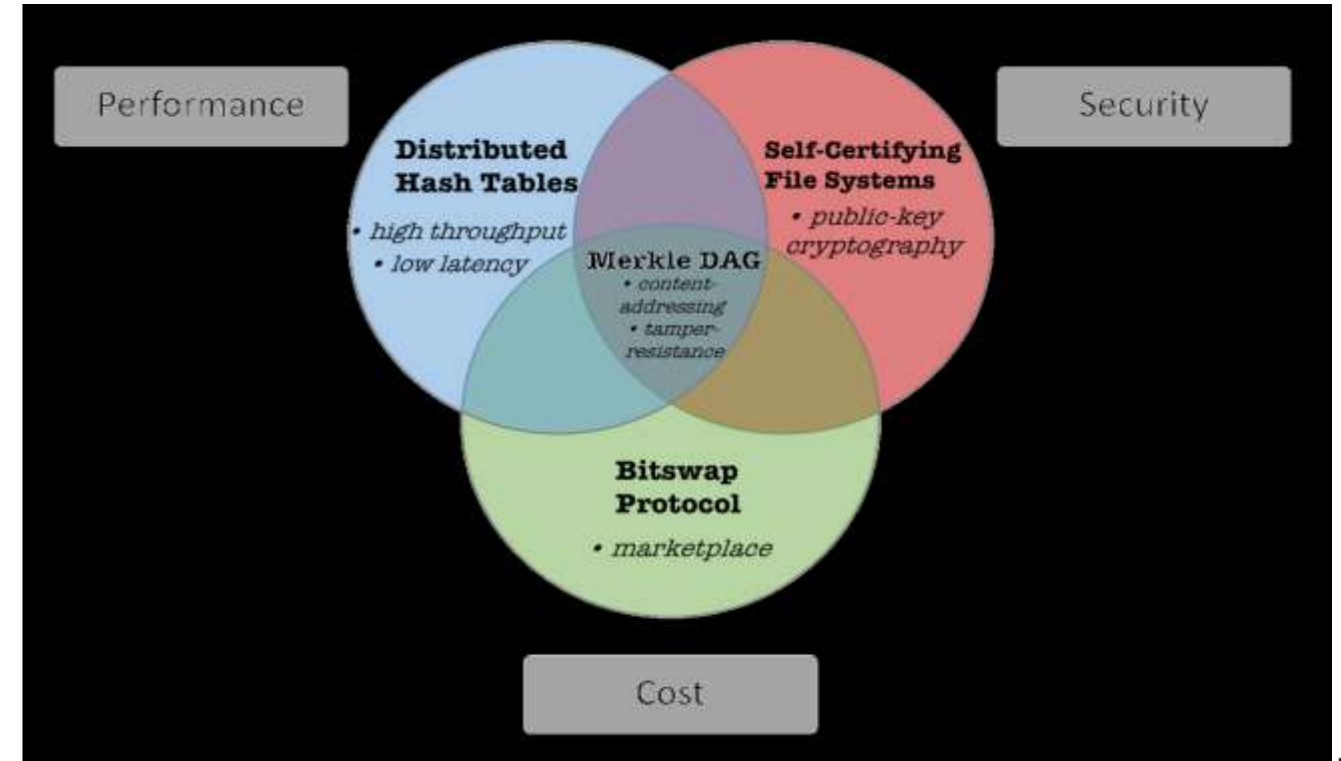
... and other similar distributed filesystems are flourishing !



Kyle Drake



Juan Benet





# Distributed filesystems e.g. Inter Planetary File System

## What does IPFS provides ?

- high throughput, low latency, data distribution
- decentralized and secure storage system
- automatic versioning & backups
- secure filesharing and encrypted communication mean

## Why is IPFS it interesting ?

- It provides a new infrastructure for the Internet, avoiding classical localization & single point of failure |
  - request
  - access
  - storage
  - certification
  - changes
  - multi-tenancy
  - bandwidth



Each file and all of the **blocks within it** are given a **unique fingerprint** called a **cryptographic hash**.



IPFS **removes duplications** across the network and tracks **version history** for every file.



Each **network node** stores only content it is interested in, and some indexing information that helps figure out who is storing what.



When **looking up files**, you're asking the network to find nodes storing the content behind a unique hash.

# Cloud enterprise platforms e.g. Amazon Web Services

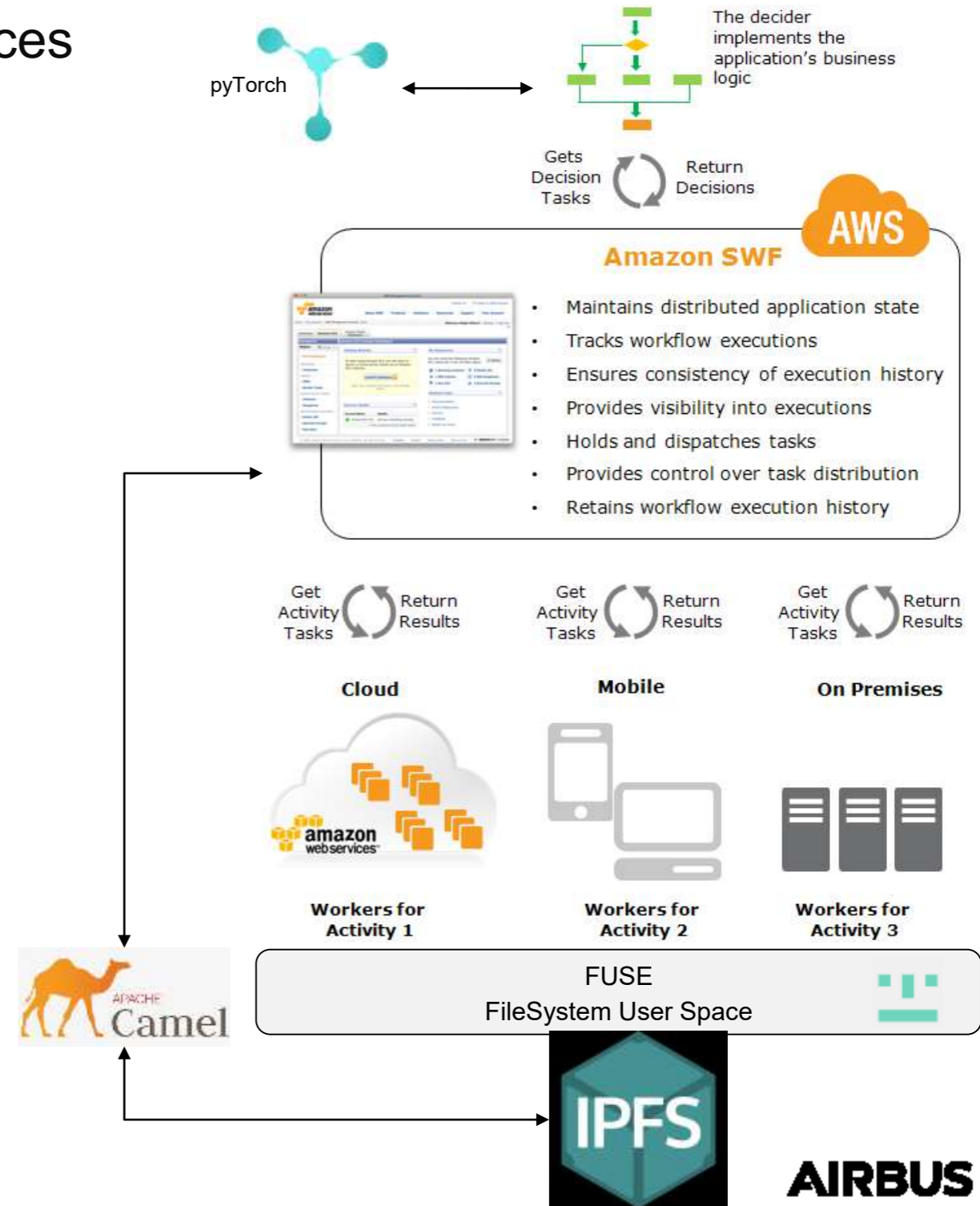
## AWS Simple Workflow Framework (SWF)

- allowing implicit & dynamic workflow to be implemented
- allow sub-execution of simulation task then reconciliation
- allow implicit & automated configuration management

## AWS Managed Blockchain

- multi-tenant cooperation in transnational environment

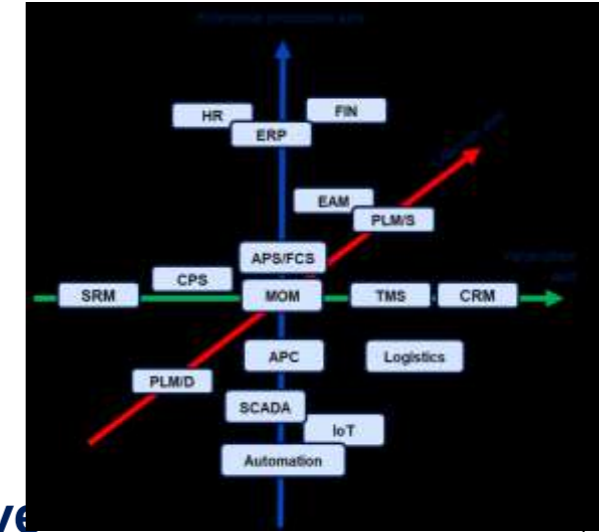
## AWS Cloudsearch...



# High level semantic integration e.g. MarkLogic / SPARQL

## Data exposure facilitated by emergence of indexing trend

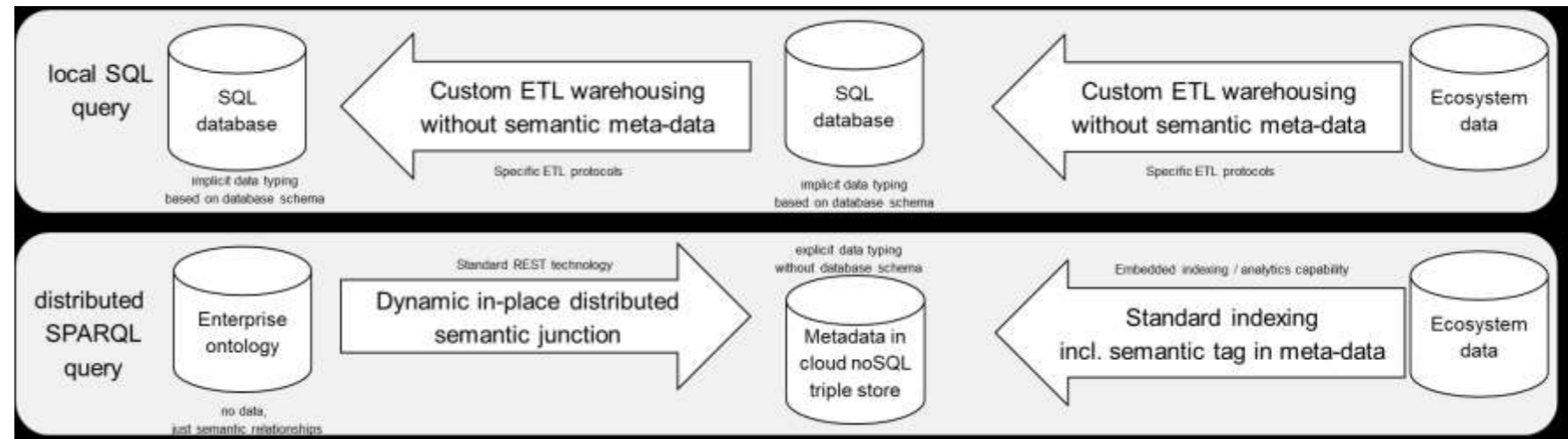
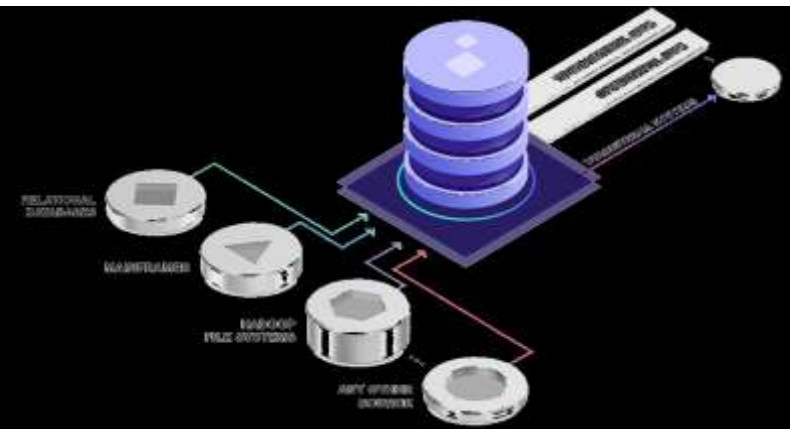
- each ecosystem use it's own indexing mechanism to expose his data
- data exposed is semantically tagged
- enterprise wide ontology federating ecosystems namespaces



## Semantic technology make previous decorative ontologies now operative

- joint across ecosystems based on semantic
- works even in extended enterprise and can perform junction dynamically in-place

- resources
- Enterprise Resource Planning
- Enterprise Assets Management
- PLM : Product Lifecycle Management
- APS : Advanced Planning & Scheduling
- FCS : Finite Capability Scheduling
- SRM : Supplier Relationship Management
- CPS : Contract Payment System
- MOM : Manufacturing Operations System
- TMS : Transaction Management System
- CRM : Customer Relationships Management
- SCADA : Supervisory Control And Data Acquisition
- APC : Acquisition & Production Cost
- IoT : Internet of Things



Source: MarkLogic

## ... putting it all together

### Distributed filesystems

- **Performance & scalability**
- **Safe complex configuration handling**
- Secure & robust change trace-ability, tracing context in which data was generated as well as the data itself
- Durability of storage (LTA = wink) (but the problem of standards lifetime remains)
- **Multi-tenant cooperation**
- **Extended enterprise**

### Cloud enterprise platforms

- Framework of services incl. workflow, distributed ledgers, indexing/search...
- Easy evolution of workflow toward **dynamic & flat** with minimum change to core activities implementation
- Workflow trace-ability can be embedded in the data at file system level, paving the way to **implicit & automated configuration management** (core technical data might still need explicit validation, many other items now handled by PLM don't)
- Microservices implementation easy to evolve
- **Extended enterprise**

### Semantic integration

- Evolutive and flexible integration mechanism, able to **overcome data models evolutions** easily
- Facilitate link to other ecosystem through **generic mechanism**, sufficient to explore relations or handle cache refresh
- Same mechanism coupled to distributed filesystems can easily give access to the remote data for more advanced / coupled applications
- **Extended enterprise**



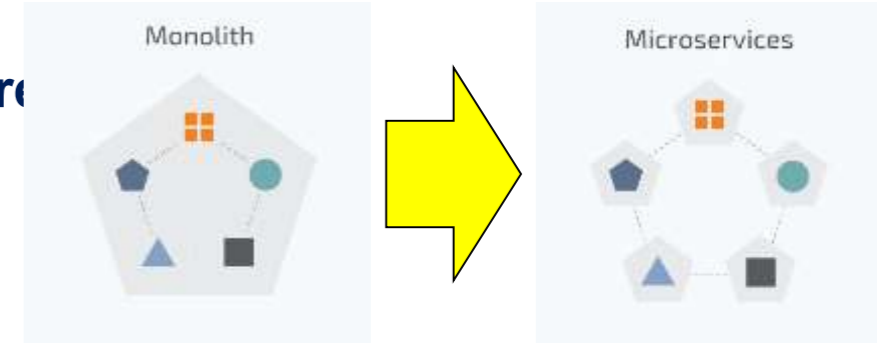
# What would next generation of PLM look like based on such approach ?

## Enterprise platform is the skeleton hosting PLM services

- most core data & services PDM needs are already there, just need to add missing data (e.g. CAD PDM)
- PLM services to be built on top, and focus on providing collaborative networked design features

## Vaulting and configuration management based on standard cloud features

- unique identification of data over the Internet, even across hybrid clouds
- versioning and configuration secured across ecosystems at filesystem level
- change management transactional and traced across ecosystems
- complex configuration dependencies maintained across ecosystems



## Workflows operated by standard cloud features, rapidly evolving from fixed & hierarchical toward dynamic & flat

- multi-tenant workflows easy to set-up (and trace if needed using distributed ledgers)
- authoring & changes happening through workflow tagged with their change context allowing dynamic and largely implicit & automated configuration management
- actual technical validation of design might still need a mandatory fixed step (provable AI issue like for autonomous vehicles or others :-)

## Specific PLM dashboard / interface still needed to deliver today's features

- but where product data & lifecycle is only a view extracted from enterprise as a platform ecosystem
- but where extended enterprise integration of data is transparent provided it is authorized



# Thank you

## Are PLM software soon to be dinosaurs ?

- PLM **needs** not soon to disappear, but focus might switch from frozen data configuration capture to change propagation
- PLM **software** as we know it seems doomed, like Unix workstations in the 90's trying to compete on all fronts, versus a modularized and optimized ecosystem that can start to deliver similar level of services

