Big Data & Analytics: Exploiting it

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Agenda

- Background to Shell
- Main IT elements at Shell
- Overall trends
- Big Data & Analytics
- Smart Solutions
- Big Data & Visualisation
- In Summary

ROYAL DUTCH SHELL - PROFILE

“I want Shell to become the world’s most competitive and innovative energy company."
Peter Voser - Chief Executive Officer of Royal Dutch Shell plc

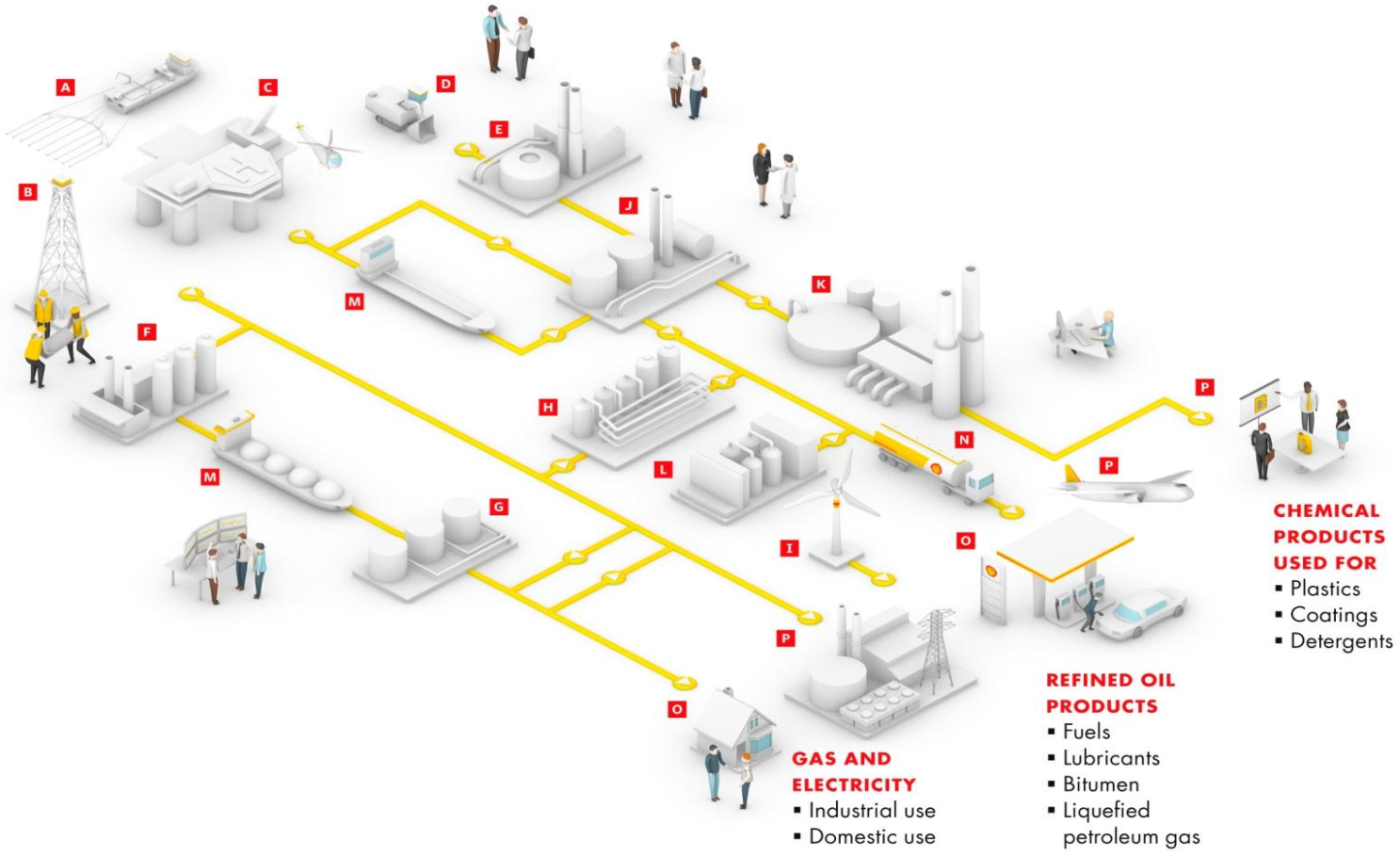
- We are active in more than 70 countries
- Worldwide, we employ on average 87,000 full-time employees
- Each day we produce 3.3 million barrels of oil equivalent
- Our fuel retail network has around 44,000 service stations
- We sell transport fuel to some 10 million customers a day
- **In 2012:**
  —We generated earnings* of $27 billion
  —We spent $29.8 billion on net capital investment
  —We spent $1.3 billion on R&D

Royal Dutch Shell plc is listed on the stock exchanges of Amsterdam, London and New York

Source: Full Year 2012 Unaudited Results

Our businesses

Upstream refers to the ways we find and extract crude oil, natural gas and oil sands
Downstream refers to the ways we transform them into products



Key parameters of the **Shell IT landscape**

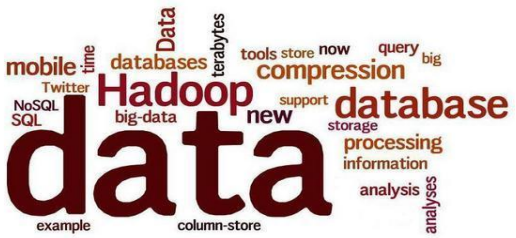
- Approx. 150,000 clients (mixture of portables / desktops / tablets):
  —Both Shell and Contractor staff.
- Approx 15,000 users with Bring Your Own Devices (BYOD), at this moment, being tablets and smartphones.
- Focus at making applications available for Mobile devices.
- Infrastructure & Middleware services are Enterprise wide and Business specific at the Application / Services level.
- Any type of IP connectivity: Very fast / Slow / High latency / etc.
- Since 2008 most of the Infrastructure services have been outsourced to three main parties.
- Mixture of ‘’On Premise’’ and Cloud Services. Whereby focus is at SaaS, but we also do have IaaS (AWS) and PaaS (Force.com & MS Windows Azure).
- Over 100 sites with OSIsoft PI.

Trends impacting the Enterprise

- **IT Consumerisation drives Client hardware and software:**
  - —Mixed ownership: Public / Private / Company.
  - —Many form factors: Smartphone / Tablet / Portable / Glasses /…
  - —Management : Mobile approach wins and therefore a single approach for all clients (Mobile Device Mgt / App Store / etc.).
  - —Various Operating Systems: MS Windows / Google Android / Apple IOS / …….
  - —Software (application) choices: Increasingly a user choice (AppStore).
  - —Application Portfolio Mgt: Needs to think again about the UI (ideally HTML5) & what device to use for what.
  - —User authentication & authorisation: Linked to type of account, type of device and location; Impact on MS AD.

Trends impacting the Enterprise

- **SaaS used as the default:**
  - —Multiple SaaS providers: Every enterprise will end up with many.
  - —Contractual challenges to be addressed.
  - —Mixed On Premise and SaaS for your workflows.
  - —Authentication (SSO) / Authorisation / Data exchange (realtime and ‘’batch’’) to be tackled; Separation of Authorisation and the actual application.
- **Increased access by non-Shell staff to Shell services:**
  - —Adding more Joint Ventures and therefore users.
  - —Therefore more complex models to be supported.
- **Big Data & Analytics:**
  - —Do not get overexcited about it: What is Big Data?
  - —The two always go together: How to handle Big Data without Analytics.



Trends impacting the Enterprise

- **The whole Enterprise, increasingly, becomes (near) realtime:**
  - —All the way from Subsurface to Retail.
  - —A large shift from a ‘’batch’’ driven world.
  - —Speed of Development & Deployment much better

- **Move towards Predictive Analytics:**
  - —Move away from Reporting to Predictive Analytics.
  - —Being able to predict and therefore prevent failure is crucial.
  - —MI/BI Tooling to be selected by users ie they expect a choice (linked to IT Consumerisation: AppStore) to be made of the AppStore.
- **Data volumes are exploding (sensors, etc.):**
  - —Sensors / New Technologies: Moved from Gbytes, via Tbytes going to Pbytes.
  - —Starting in Subsurface: Seismic, Wells, etc.
  - —(As an example) Complex Event Processing (CEP) is vital to be able to keep up with data flows.

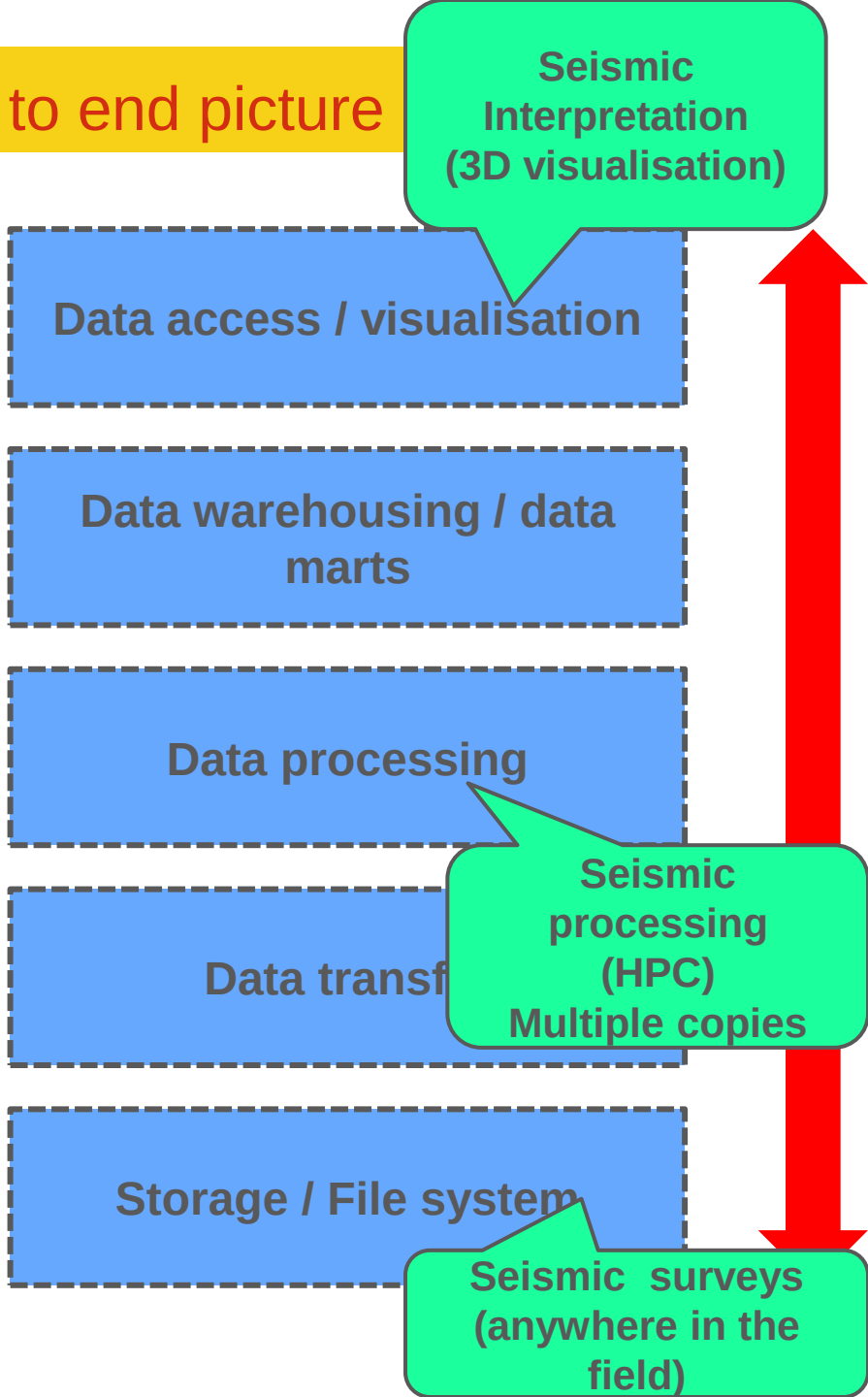
Trends impacting the Enterprise

- **Regional and/or Global Operations & Management:**
  - —Fields / Plants are managed (ie not just monitoring) at a regional or global level.
  - —Lowering staffing levels.
  - —Knowledge Management (based on CEP).
- **Operational dependency driving better data qual**
  - —Data is the basis for Operational decisions.
  - —This creates a natural drive to improve data quality.
  - —Importance of an Enterprise Data Model.

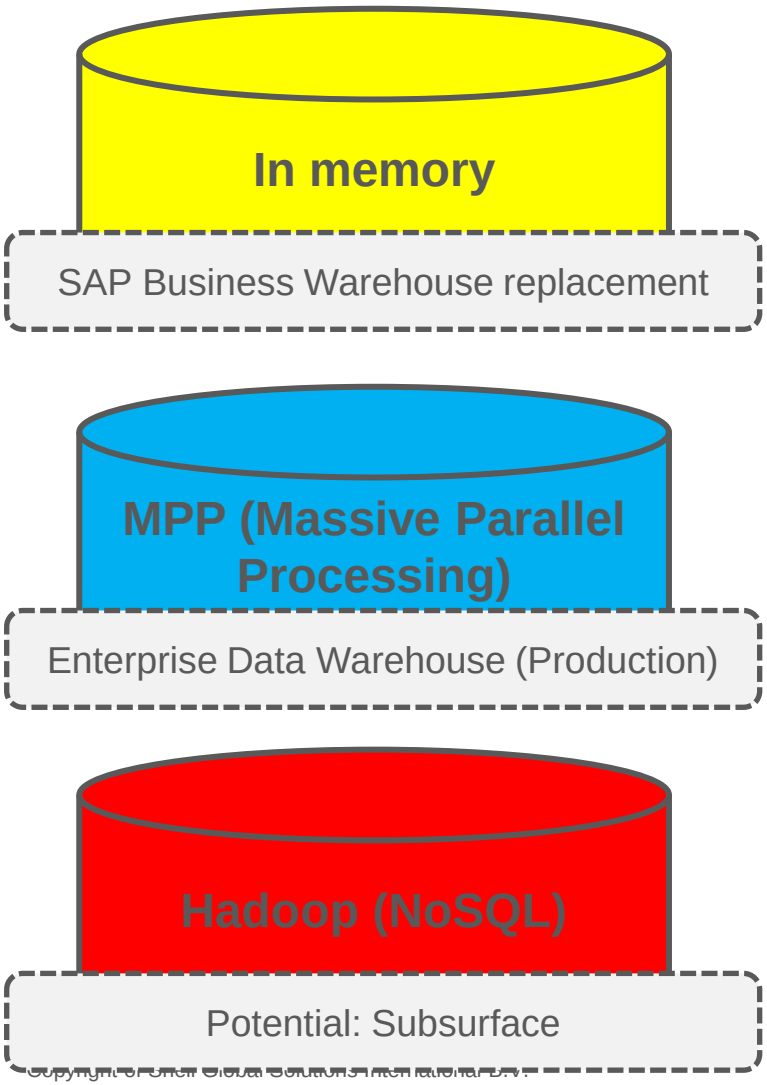
- **Single version ‘’of the truth” for your data:**
  - —We know the master (location and DDO) for each data element.
  - —Global data model in place used across the different parts of the Enterprise (Upstream and Downstream): Once consistent ‘’face’’ for all data to the users.
  - —Master data management.

Big Data: Looking at the end to end picture

- Definition from Wikipedia**: Big data** is a term applied to data sets whose size is beyond the ability of commonly used software tools to capture, manage, and process the data within a tolerable elapsed time. Big data sizes are a constantly moving target currently ranging from a few dozen Terabytes to many Petabytes of data in a single data set.
- Big Data is a paradigm shift
- Big data capabilities play in many parts of the stack
- Need ‘horses for courses’; ie carefully consider what combination of technology to use – there is no one size fits all – it is not a silver bullet
- Needs holistic approach (consider the full business segment and choose the right capabilities)



Big Data: Database technologies / examples



- An In-Memory DataBase (IMDB; Also Main Memory DataBase system or MMDB) is a database management system that primarily relies on main memory for computer data storage.
- MPP architectures consist of independent processors or servers executing in parallel. Most MPP architectures implement a "shared-nothing architecture" where each server operates self-sufficiently and controls its own memory and disk.
- Hadoop is a free, Java-based programming framework that supports the processing of large data sets in a distributed computing environment.

(Big Data &) Predictive Analytics Examples

- **Realtime Data (RD) + Complex Event Processing (CEP):**
  - —Recognising pre defined patterns in multiple (real time) data streams:
    - —Currently available as part of Shell SSP (Smart Solution Platform) service.
    - —Wells Drilling Rigs: Under development.
    - —ArcSight implementation (collecting all system and network logs): Available.

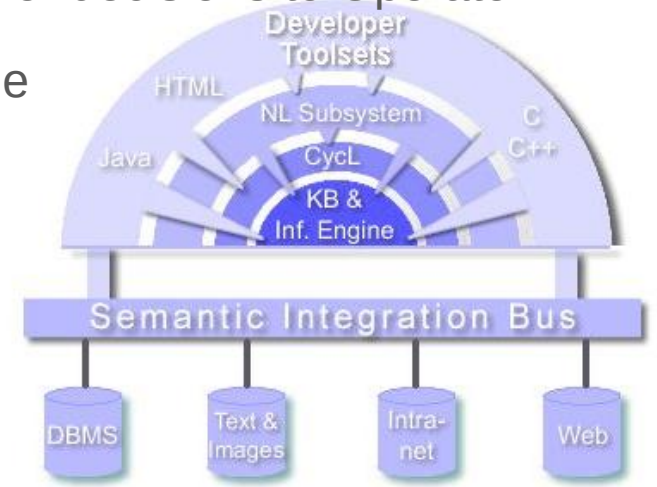
- **RD + Historical Data + Analytical Modelling:**
  - —Using both current and historical data as input
  - —Different models (statistical / analytical).
  - —Smart Perform Multivariable Statistical Modelling for Oil Sands.
  - —Proxy Models for Modelling of Injector – Producer Connectivities.
  - —Auto-Updating of First Principles Models for Well and Facilities Management.
  - —Statistical modeling for Groningen gas field production.

(Big Data &) Predictive Analytics Examples

- **RD + CEP + Alert Classification / Self Learning Knowledge Base (KB).**

  —RD and CEP give input to KB to provide choice for decisions to Operator (as part of the Shell implementation):

  - PoC: For managing Wells using AI knowledge base.



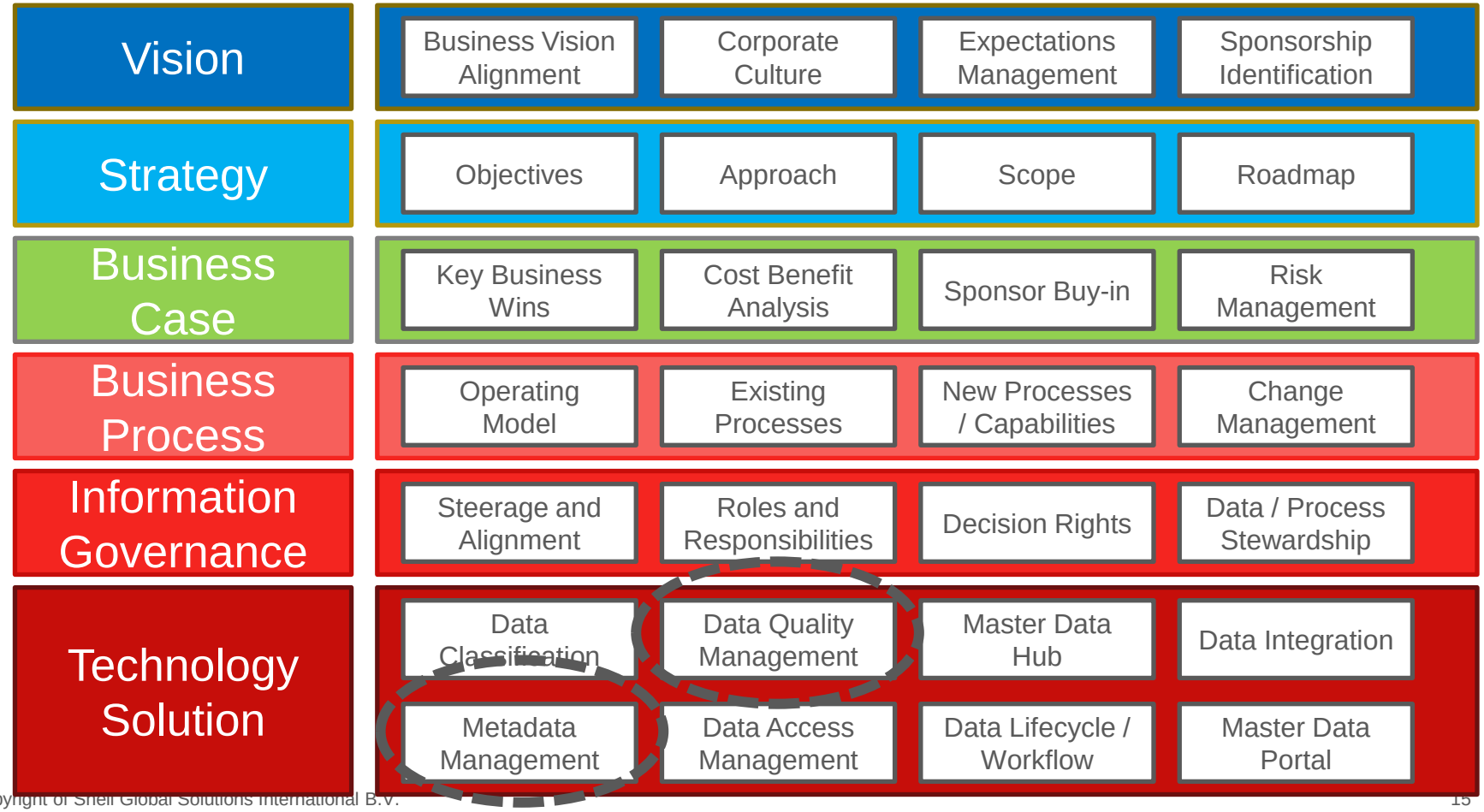
- **All of the above + Reference Data (as an example: IBM Watson):**

  —Loading lots of information and can be handled by Watson (books / manuals / references / etc.).

  —Using this data answers to questions can be given.

Big Data: Master Data Management

- Master Data Management is a technology-enabled discipline in which business and IT work together to ensure the uniformity, accuracy, stewardship, semantic consistency and accountability of the enterprise's official, shared master data assets (Gartner)



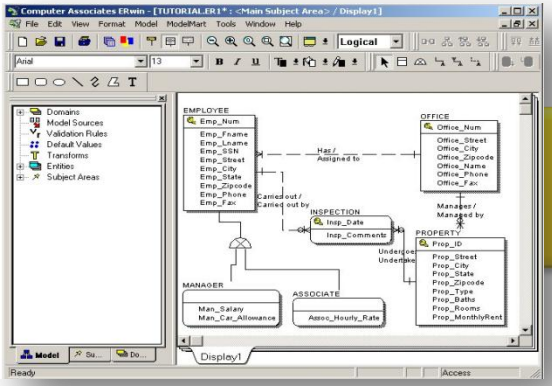
What is a data model?

Data Models are to Databases what Blueprints are to Houses.

Blueprint

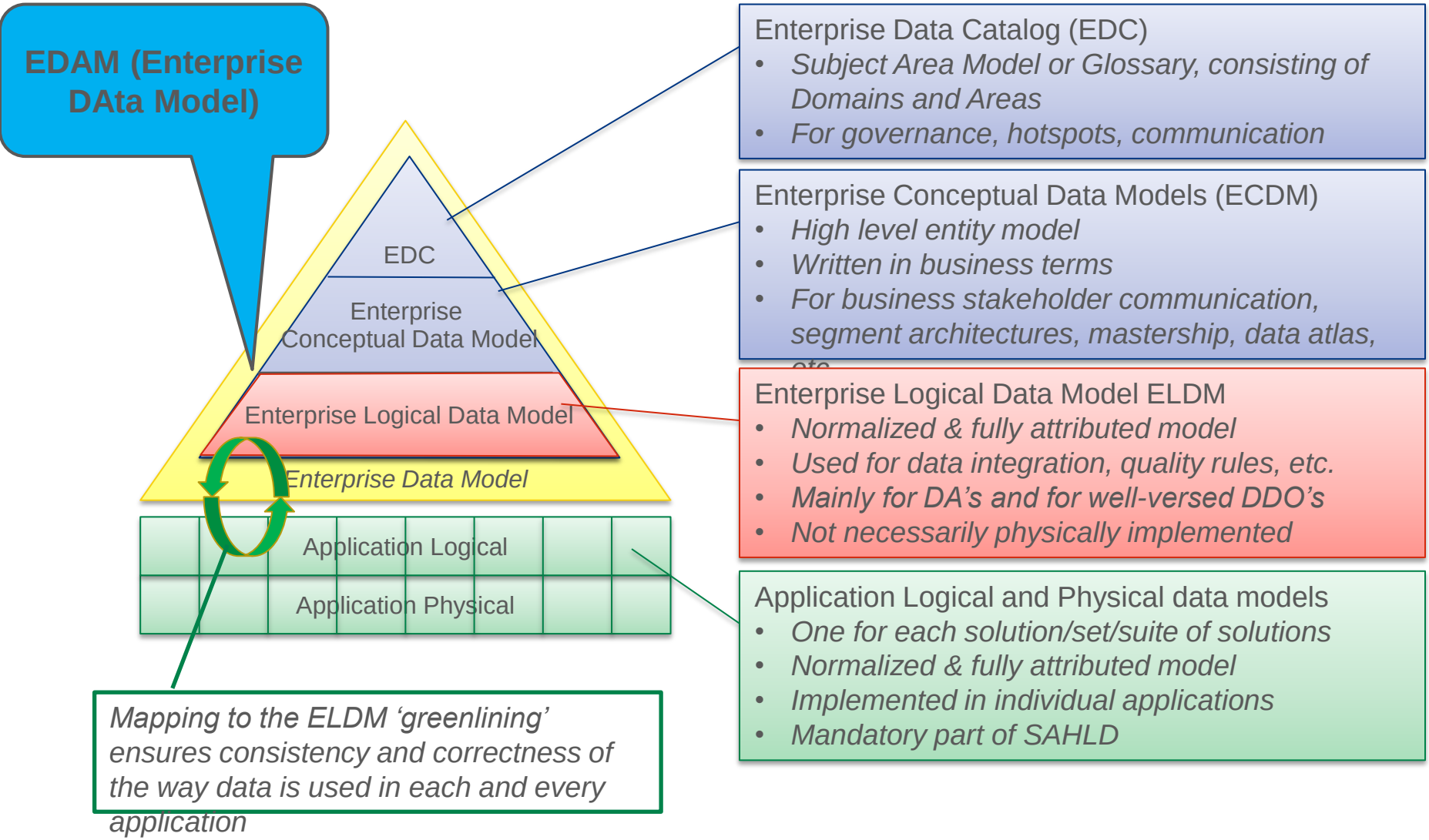
House

Data Model

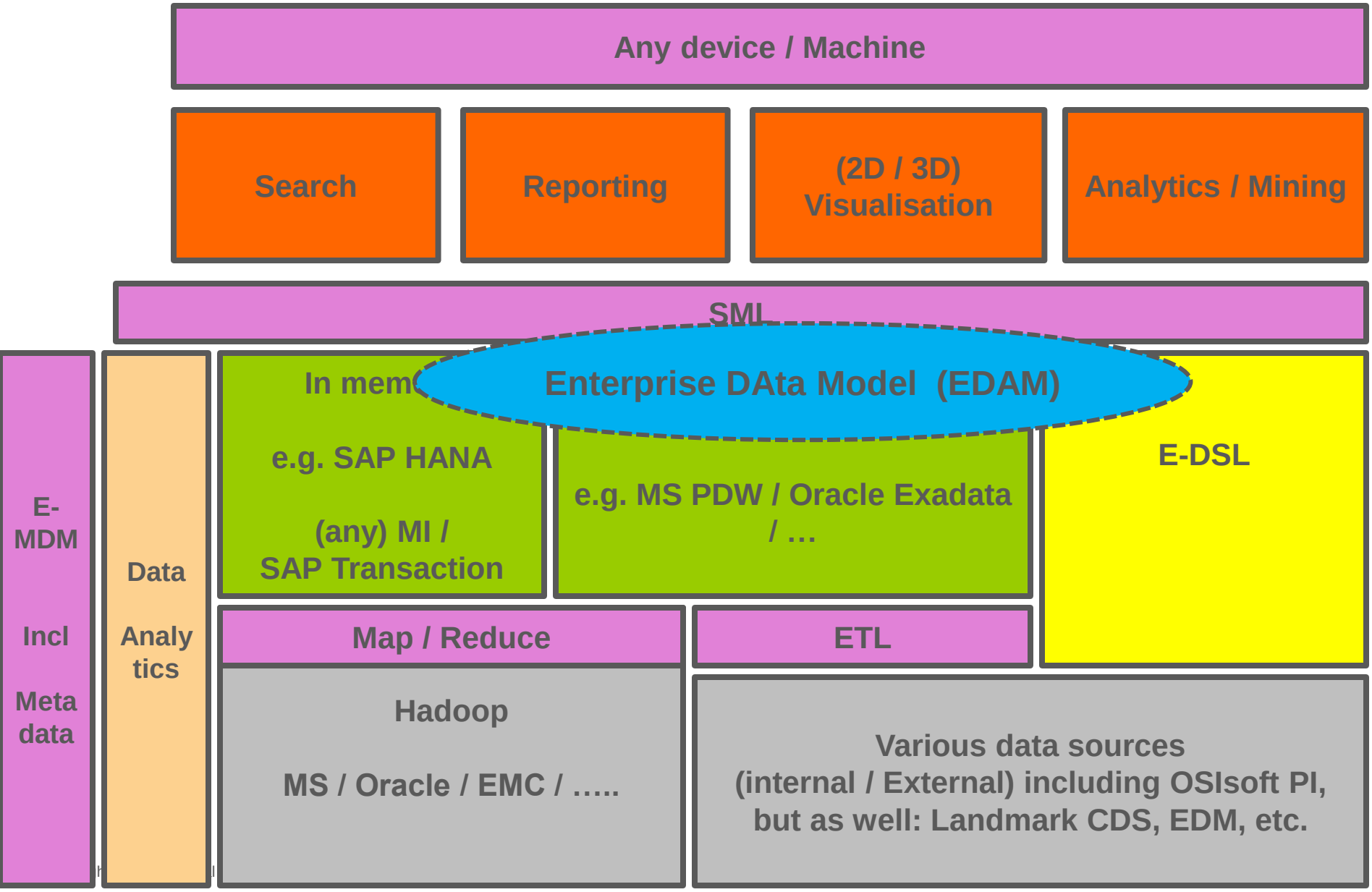


Database

Data Model levels and their role

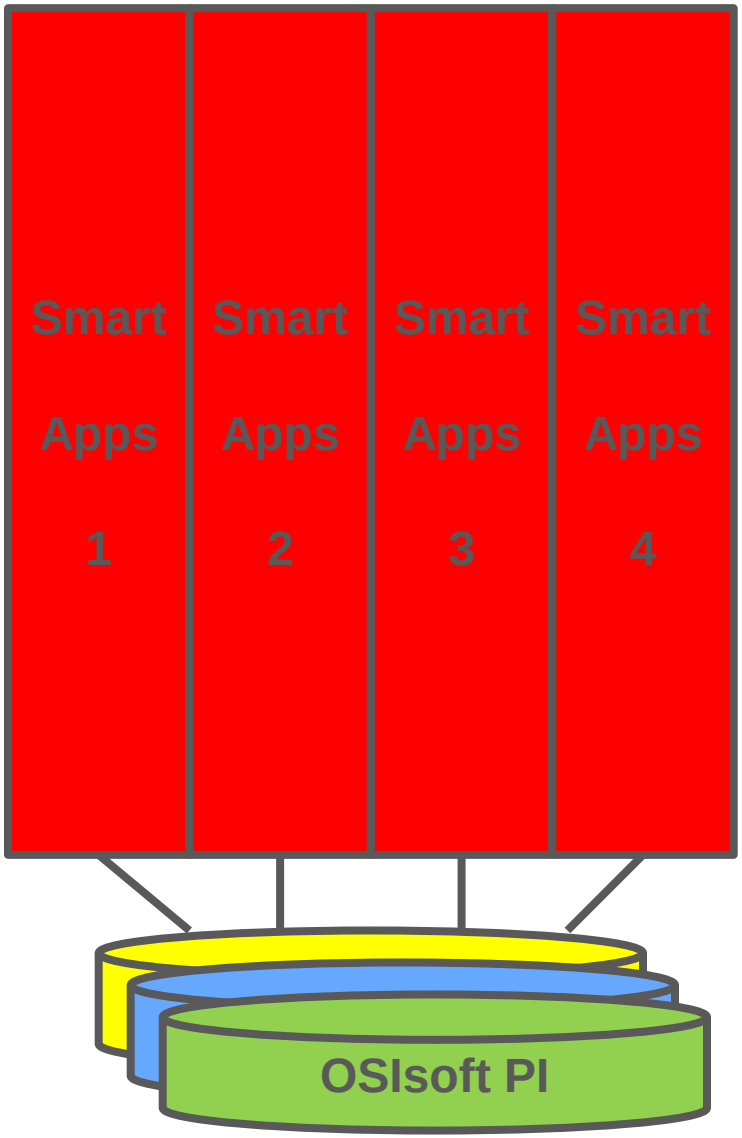


Big Data: Updated **Enterprise** MI Strategy



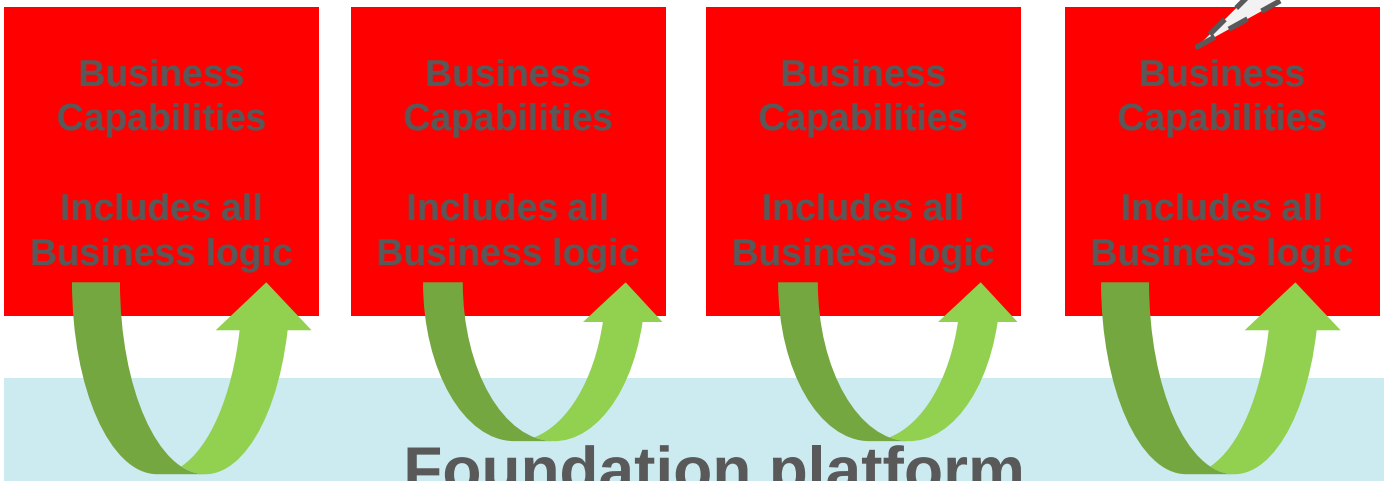
Smart Solutions: History

- Applications developed in isolation from each other, therefore self sufficient and duplication of activities: All with own connection to data sources; All separate UIs; All own calculation engines; All with own data model; Own Visualisation tooling; etc.
- All installed on separate IT Infrastructure.
- All supported individually.
- No common approach to the data sources.
- No optimisation between Upstream and Downstream.
- Results in “silo” mentality, no synergies, additional overhead costs, different teams doing the same activities and competing for resources



Smart Solutions: Foundation platforms

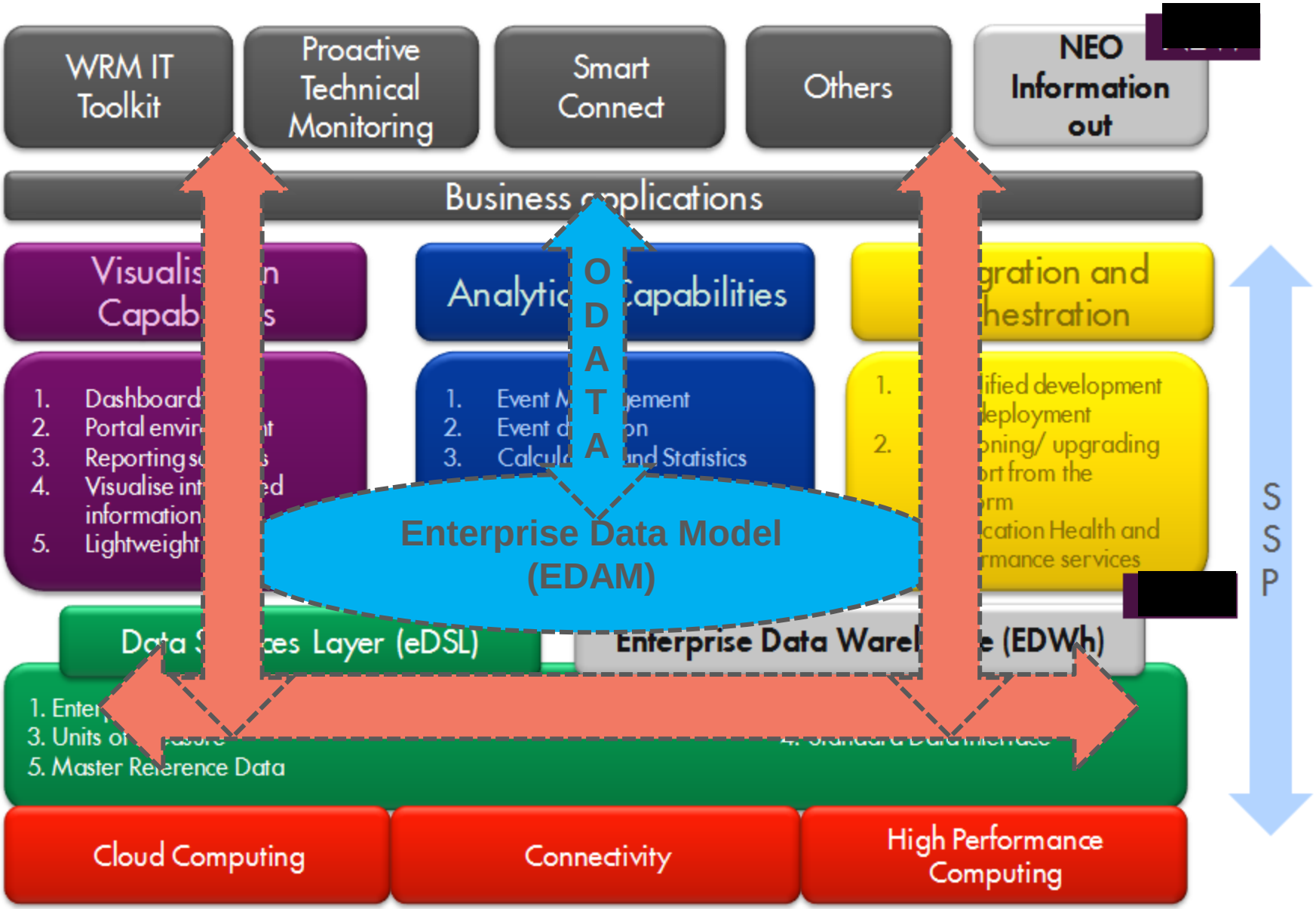
Business Applications focus at logic



Foundation platform

Has all common IT elements such as:
Visualisation/Reporting tooling / UI definitions
Calculation Engines
Portal
Alarm / Event Management
Data Services Layer
Data sources
Etc.

Smart Solutions Platform (SSP): Overall framework



Big Data: Opportunities

- **One example: In memory:**

—When speed brings value.

— Being able to compare activities at different locations (all loaded in a single set-up).

— Being able to go much further back in time (to compare / validate).

—Being able to run realtime analytics on a larger scale.

Visualisation: Opportunities

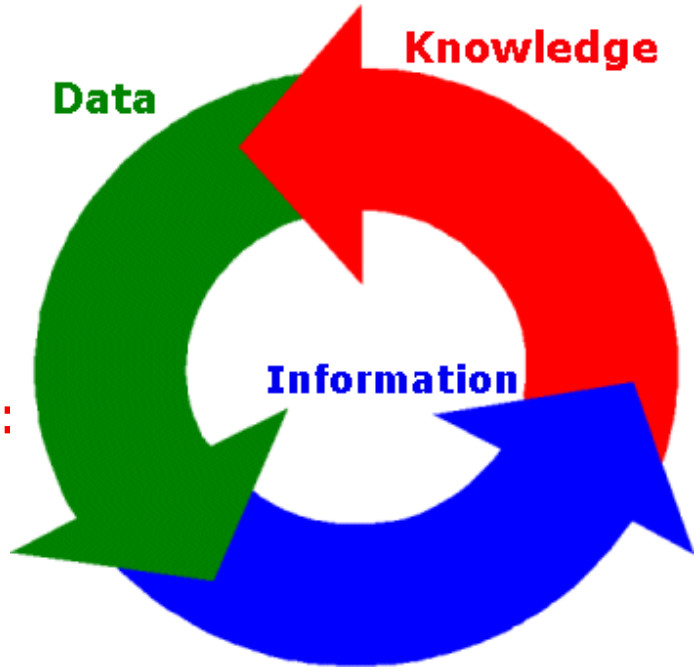
- **3D Visualisation:**
  - —Link back to your 3D Engineering models.
  - —Set up for augmented reality → However make sure that you get your data correct (Enterprise Data Model / MDM / Data Quality).

- **Far more choice for slicing & dicing:**
  - —Thanks to the Mobile developments: Tablets in particular (and therefore very relevant for Field workers → IT Consumerisation).
  - —ODATA as the enabler: Therefore make that part of your plans.

- **Linkage to Analytics:**
  - —Analytics to drive selection of output.

In Summary

- **Data → Data → Data → Data → Data → Data → Information**
  - —Quality.
  - —Known single version of the truth.
  - —Enterprise Data model.
  - —Create Information.



- **Exploit external IT Trends such as:**
  - —IT Consumerisation
  - —Cloud (SaaS)
  - —ODATA

- **Optimise development of Smart Applications:**
  - —Foundation platforms / Services (REST) / etc.

THANK YOU

Discover more at www.shell.com