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# Analytical Database:

RDBMS of MDDS?

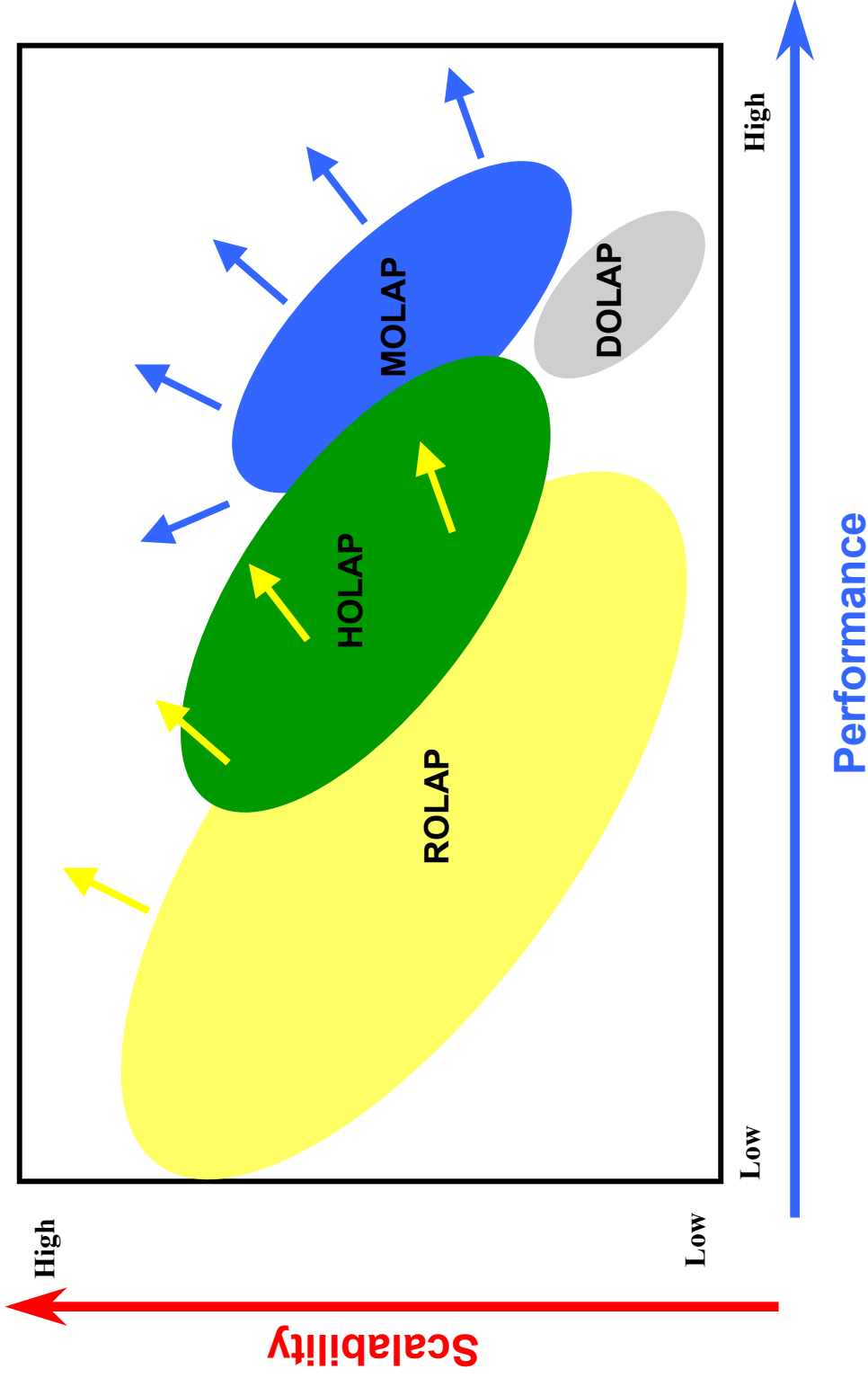
# Agenda

- Inleiding: Definities & Speelveld
- 19:00 – 19:45 Analytische Mogelijkheden RDBMS
- 19:45 – 20:00 Pauze
- 20:00 – 20:45 Analytische Mogelijkheden MDMS
- 20:45 – 21:00 Conclusie, Vragen & Afsluiting

# Definities

- OLTP = OnLine Transactional Processing
  - RDBMS
  - 12 regels van Codd
  - Operationele (transactieverwerkende) systemen
- OLAP = OnLine Analytical Processing
  - MDDS
  - Ook 12 regels van Codd
  - Later ook regels van Inman & Kimball
  - Analyse-omgevingen (DWH & DM)
  - Verschillende varianten: ROLAP, MOLAP, HOLAP

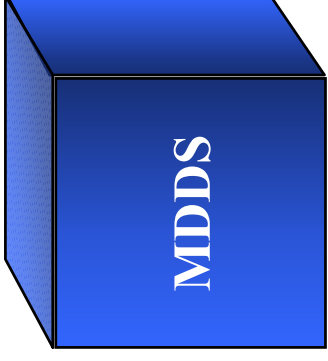
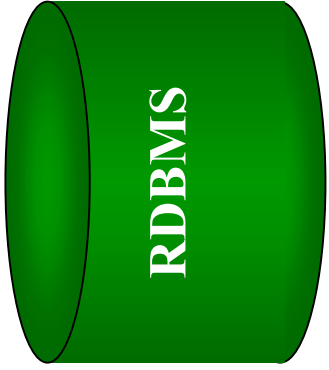
# OLAP varianten



Approaches To OLAP, Patricia Seybold Group, February 1996.

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# Speelveld



# Analytical Database: ROLAP

*De Analytische Mogelijkheden van het  
welbekende Oracle RDBMS*

# Relational OLAP

1. *Ranking Functions*
2. *Windowing Aggregate Functions*
3. Reporting Aggregate Functions
4. LAG/LEAD Functions
5. FIRST/LAST Functions
6. Linear Regression Functions

# Relational OLAP

7. Inverse Percentile Functions
8. Hypothetical Rank and Distribution Functions
9. WITH\_BUCKET Function
10. User-Defined Aggregate Functions
11. CASE Expressions

# 1. Ranking Functions

- **RANK** and **DENSE\_RANK**
  - **RANK()** OVER([query\_partition\_clause] [order\_by\_clause])
  - **DENSE\_RANK()** OVER([query\_partition\_clause] [order\_by\_clause])
- **CUME\_DIST** and **PERCENT\_RANK**
  - **CUME\_DIST()** OVER ([query\_partition\_clause] [order\_by\_clause])
- **NTILE**
  - **NTILE**(expr) OVER([query\_partition\_clause] [order\_by\_clause])
- **ROW\_NUMBER**
  - **ROW\_NUMBER()** OVER([query\_partition\_clause] [order\_by\_clause])

# Example: RANK

What are the top 3 sales regions per month?

```
SELECT month, region, sales  
RANK() OVER (PARTITION BY month ORDER BY sales DESC) rank_sales  
FROM homes GROUP BY month  
WHERE rank_sales <= 3;
```

Data:

Month	Region	Sales
Nov-2002	Utrecht	456,000
Nov-2002	Amsterdam	438,000
Nov-2002	Rotterdam	438,000
Nov-2002	The Hague	399,000
Dec-2002	Amsterdam	632,000
Dec-2002	The Hague	544,000
Dec-2002	Utrecht	523,000
Dec-2002	Rotterdam	488,000

# Example: RANK

What are the top 3 sales regions per month?

```
SELECT month, region, sales  
RANK() OVER (PARTITION BY month ORDER BY sales DESC) rank_sales  
FROM homes GROUP BY month  
WHERE rank_sales <= 3;
```

Data:

Month	Region	Sales	Rank_sales
Nov-2002	Utrecht	456,000	1
Nov-2002	Amsterdam	438,000	2
Nov-2002	Rotterdam	438,000	2
Nov-2002	The Hague	399,000	4
Dec-2002	Amsterdam	632,000	1
Dec-2002	The Hague	544,000	2
Dec-2002	Utrecht	523,000	3
Dec-2002	Rotterdam	488,000	4

# Example: RANK

What are the top 3 sales regions per month?

```
SELECT month, region, sales  
RANK() OVER (PARTITION BY month ORDER BY sales DESC) rank_sales  
FROM homes GROUP BY month  
WHERE rank_sales <= 3;
```

Result:

Month	Region	Sales	Rank	sales
Nov-2002	Utrecht	456,000	1	
Nov-2002	Amsterdam	438,000	2	
Nov-2002	Rotterdam	438,000	2	
Dec-2002	Amsterdam	632,000	1	
Dec-2002	The Hague	544,000	2	
Dec-2002	Utrecht	523,000	3	

## 2. Windowing Aggregate Functions

- *Moving Average*
- *Moving Sum*
- *Moving Min/Max*
- *Cumulative Sum*

# Example: Cumulative Sum

What are the cumulatives for each month, region per year?

```
SELECT month,region  
sum(sales) OVER (PARTITION BY month, region ORDER BY month)  
cum_sales
```

```
FROM homes GROUP BY month, region;
```

Data:

Month	Region	Sales
Jan-2002	Utrecht	456,000
Feb-2002	Amsterdam	438,000
Mar-2002	Rotterdam	438,000
Apr-2002	The Hague	399,000
Jan-2003	Amsterdam	632,000
Feb-2003	The Hague	544,000
Mar-2003	Utrecht	523,000
Apr-2002	Rotterdam	488,000

# Example: Cumulative Sum

What are the cumulatives for each month, region per year?

```
SELECT month,region  
sum(sales) OVER (PARTITION BY month, region ORDER BY month)  
cum_sales  
FROM homes GROUP BY month, region;
```

Data:

Month	Region	Sales	Cum_sales
Jan-2002	Utrecht	456,000	456,000
Feb-2002	Amsterdam	438,000	894,000
Mar-2002	Rotterdam	438,000	1,332,000
Apr-2002	The Hague	399,000	1,731,000
Jan-2003	Amsterdam	632,000	632,000
Feb-2003	The Hague	544,000	1,176,000
Mar-2003	Utrecht	523,000	1,699,000
Apr-2002	Rotterdam	488,000	2,187,000

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**D E M O N S T R A T I O N**

# **Relational OLAP**

**(via Discoverer)**

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# More Information

- Information on OTN
  - [http://otn.oracle.com/products/bi/pdf/o9i\\_analyticsql\\_twp.pdf](http://otn.oracle.com/products/bi/pdf/o9i_analyticsql_twp.pdf)
  - [http://otn.oracle.com/products/discoverer/files/viewlets/9iAS\\_Disco\\_Viewlet\\_part2\\_viewlet.html](http://otn.oracle.com/products/discoverer/files/viewlets/9iAS_Disco_Viewlet_part2_viewlet.html)
  - <http://otn.oracle.com/products/discoverer/content.html>
  - <http://otn.oracle.com/products/bi/9idbbi.html>
- Oracle9i Data Warehousing Guide
  - Hoofdstuk 19 SQL for Analysis in Data Warehouses  
(Available via Metalink)

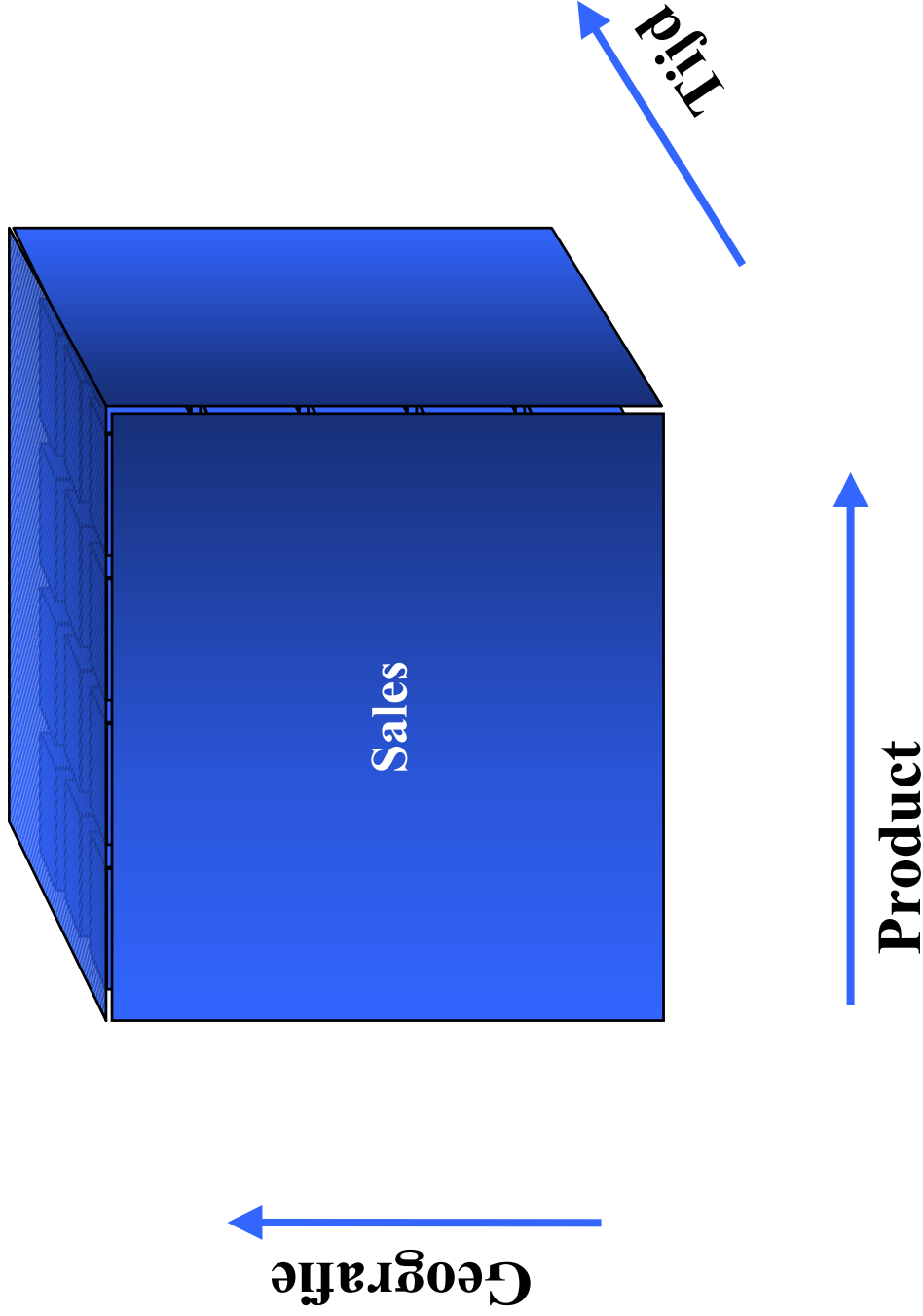
# Analytical Database: MOLAP

*De Analytische Mogelijkheden van het  
minder bekende Oracle MD DS*

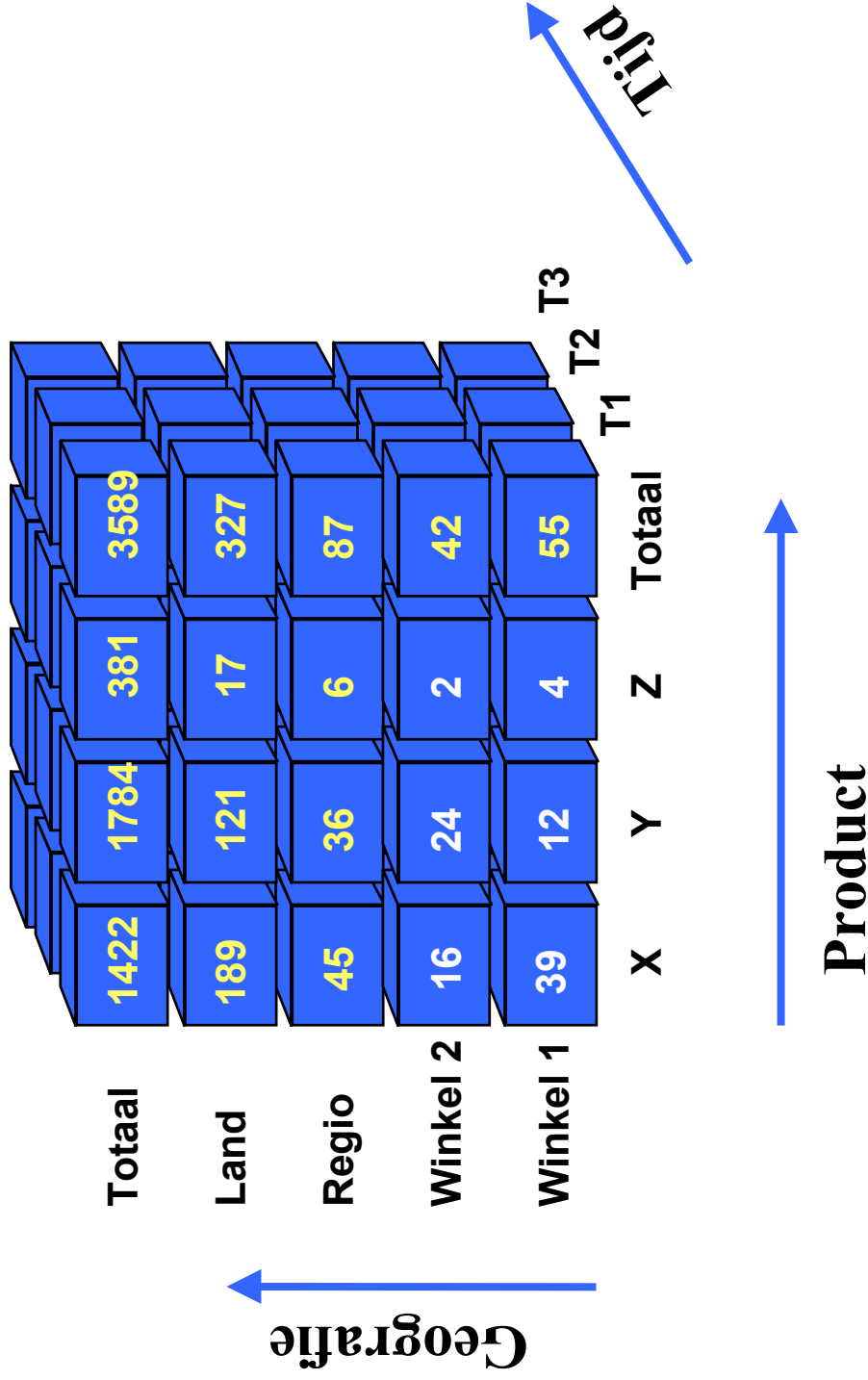
# Wat is Multidimensionaal?

- Uni-dimensionaal
  - “Wie zijn mijn top 10 klanten?”
- Multi-dimensionaal
  - “Wat was het **veranderingspercentage** voor mijn markt **aandeel** voor een **groep** van mijn top 20% produkten voor een **drie-maandelijkse periode** versus **diezelfde periode** vorig jaar voor alle klanten waarbij meer dan 15% groei is gerealiseerd in omzet?”

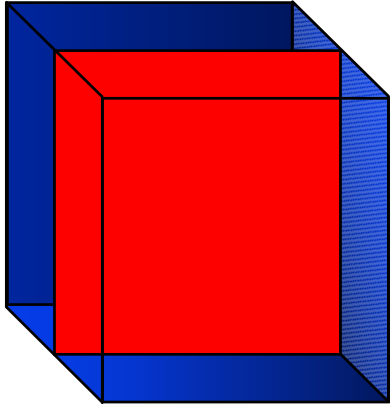
# Wat is Multidimensionaal?



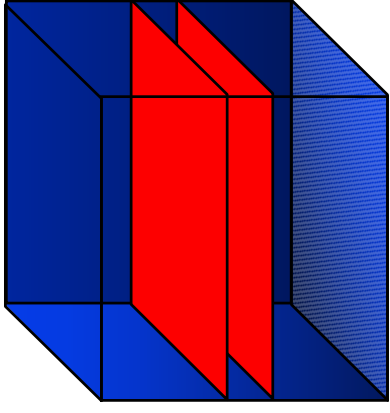
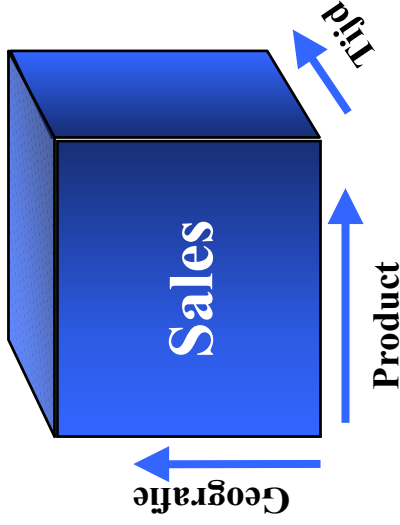
# Wat is Multidimensionaal?



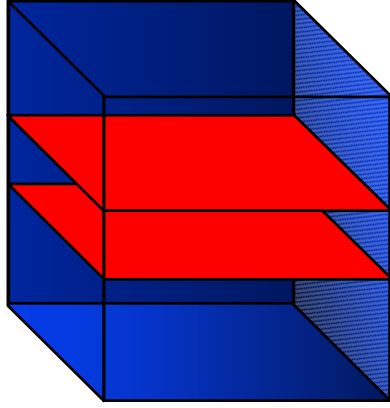
# Wat is Multidimensionaal?



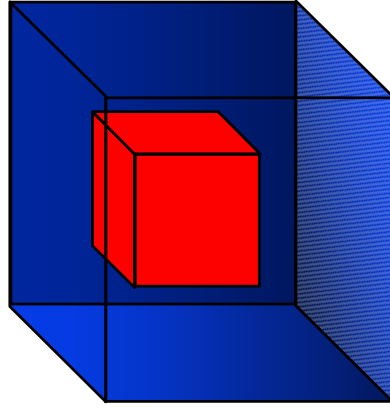
**Finance Manager**



**Region Manager**

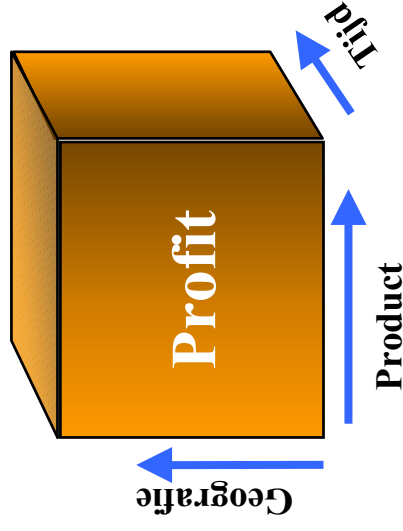
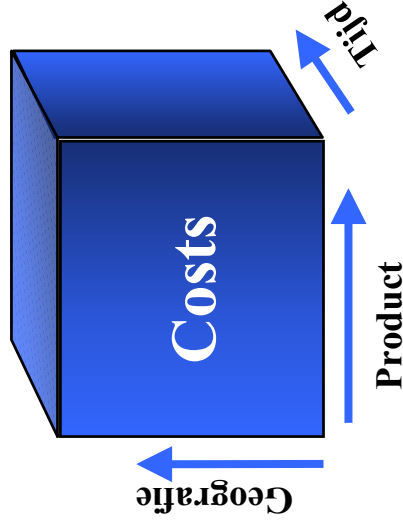
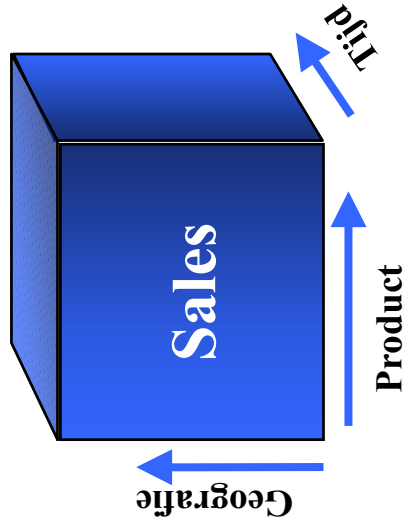


**Product Manager**



**Ad Hoc View**

# Wat is Multidimensionaal?



$$\text{Sales} - \text{Costs} = \text{Profit}$$

# Multidimensionale Calculaties

- **Numeriek/Time Series**  
Average, Cumulative Sums, Lag/Lead, Variance, Moving Average/Total, Smallest/Largest, Standard Deviation, Total, etc.
  - **Statistiek**  
Categorization, correlation, deviations, etc.
  - **Regressie**  
Multi-linear, weighted, etc.
  - **Custom dimension members**  
Unieke regels per dimensie waarde.
  - **Eigen Functies/Procedures**  
Middels Express/SPL of OLAP/DML
- **Numeriek/Time Series**  
Average, Cumulative Sums, Lag/Lead, Variance, Moving Average/Total, Smallest/Largest, Standard Deviation, Total, etc.
  - **Aggregaties**  
Non-additief, per dimensie
  - **Financieel**  
Depreciation, Growth Rate, Net Present Value, Internal Rate of Return, etc.

# Planning Functions

- Statistical forecasting
  - Non-linear regressions, exponential smoothing, Holt/Winters, etc
- Allocations
  - Hierarchical and non-hierarchical; Copy, even distribution and proportional methods
  - Cell level locking
- Models
  - Unique calculation rules per dimension member
  - Automatically ordered
- Scenario management
  - Session level update
  - Session level DDL
  - Persist personal view of scenarios

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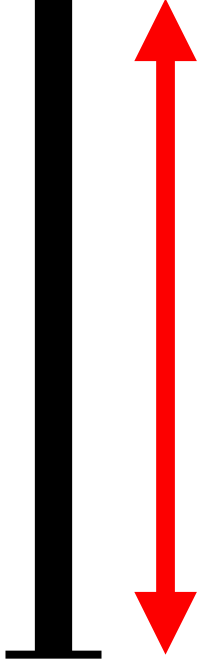
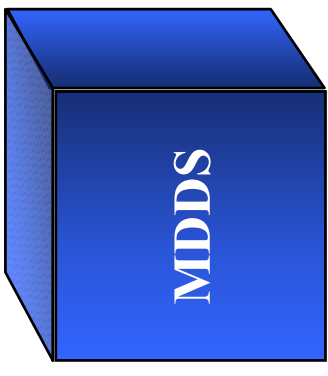
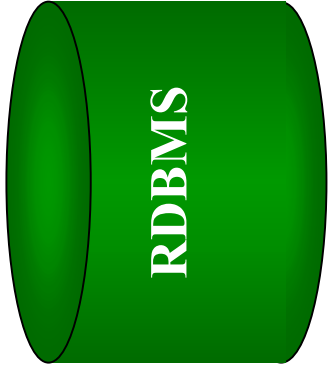
**D E M O N S T R A T I O N**

# **Multidimensional OLAP**

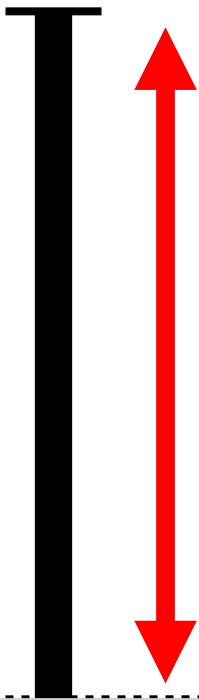
**(via BI Beans)**

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# Conclusie



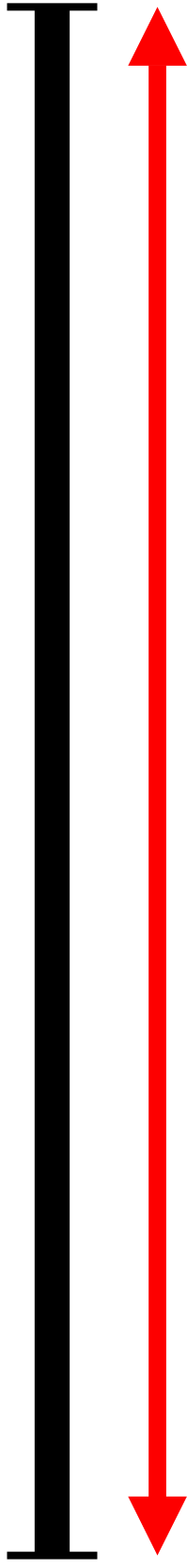
- Standaard Rapportage
- Veel Data (Schaalbaarheid)
- (Complexe) Analyse
- SQL kennis



- Meer (Standaard) Functies
- Complexere Analyses
- Gebruiksgemak
- Budgeting (Models, Allocations)
- Forecasting

# Conclusie

# Oracle *9i*



- Standaard Rapportage
- Veel Data (Schaalbaarheid)
- (Complexe) Analyse
- SQL kennis

- Meer (Standaard) Functies
- Complexere Analyses
- Gebruiksgemak
- Budgeting (i.e. Models)
- Forecasting

# Meer Informatie?

- Oracle Global Websites

<http://www.oracle.com>

<http://otn.oracle.com>

<http://metalink.oracle.com>

- Oracle 9i OLAP Services

[http://otn.oracle.com/products/bi/pdf/o9ir2\\_olap\\_bwp.pdf](http://otn.oracle.com/products/bi/pdf/o9ir2_olap_bwp.pdf)

# QUESTIONS ANSWERS

