

Business Information Systems

02: Business Application Systems

Ulrich Remus



IT Spending by Sector, Worldwide, 2015-2021



	2017 Spending	2017 Growth (%)	2018 Spending	2018 Growth (%)	2019 Spending	2019 Growth (%)
Data Center Systems	181	6.3	188	3.7	190	1.1
Enterprise Software	352	8.8	391	11.1	424	8.4
Devices	663	5.1	706	6.6	715	1.3
IT Services	933	4.4	1,003	7.4	1,048	4.6
Communications Services	1,392	1.3	1,452	4.3	1,468	1.1
Overall IT	3,521	3.8	3,740	6.2	3,846	2.8

Overall IT	3,385	3,395	3,508	3,658	3,764	3,874	3,991
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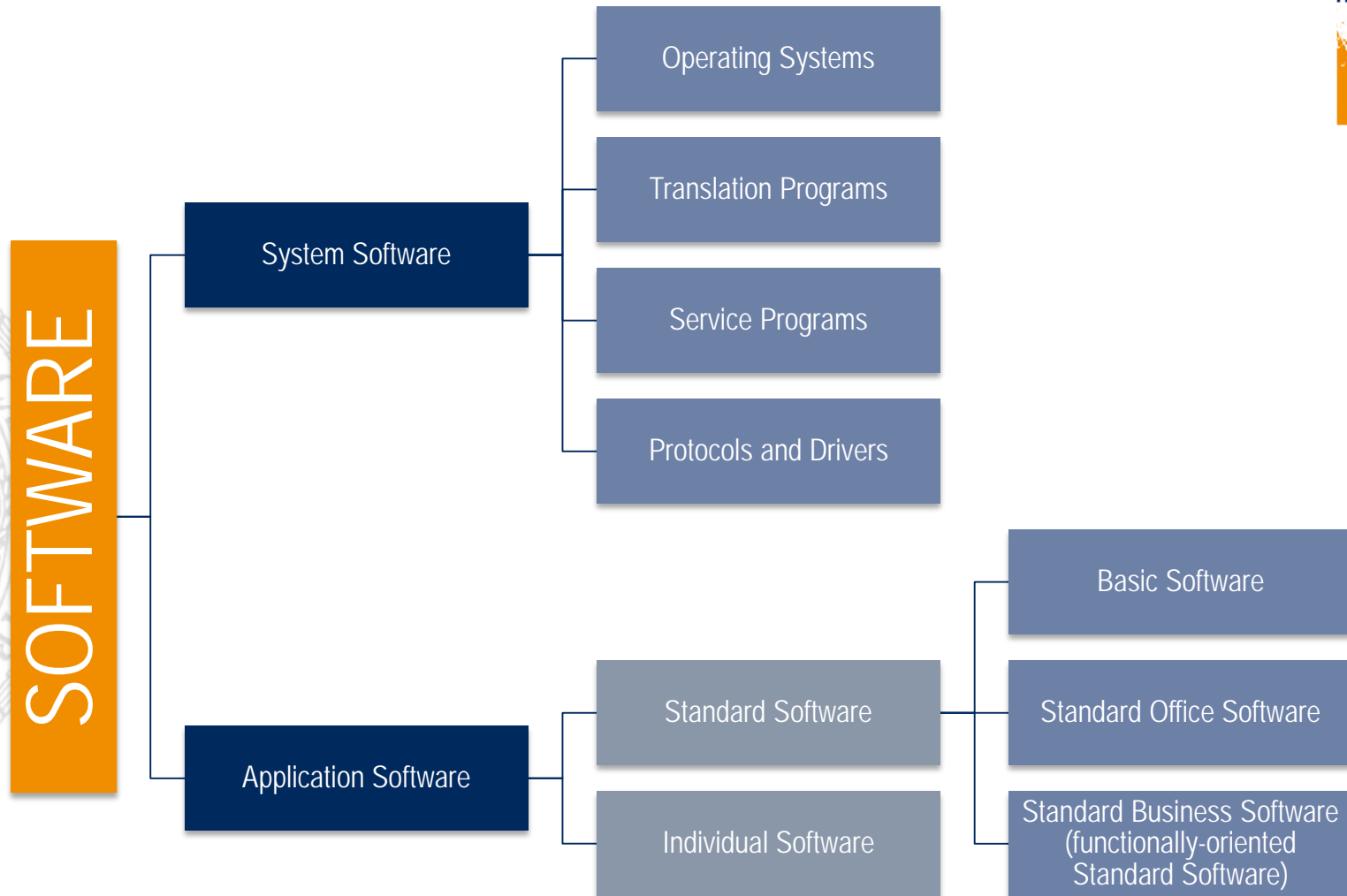
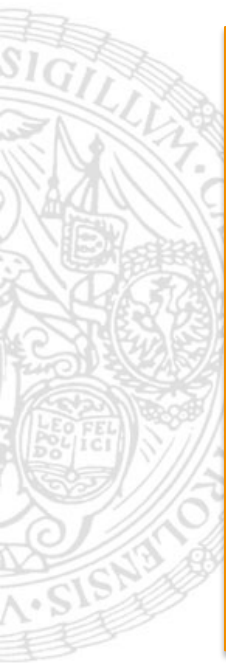
source: Gartner 2017a

Types of Information Systems

Type of System	Function	Example
Functional area IS	Supports the activities within specific functional area.	System for processing payroll
Transaction processing system	Processes transaction data from business events.	Walmart checkout point-of-sale terminal
Enterprise resource planning	Integrates all functional areas of the organization.	Oracle, SAP system
Office automation system	Supports daily work activities of individuals and groups.	Microsoft® Office
Management information system	Produces reports summarized from transaction data, usually in one functional area.	Report on total sales for each customer
Decision support system	Provides access to data and analysis tools.	“What-if” analysis of changes in budget
Expert system	Mimics human expert in a particular area and makes decisions.	Credit card approval analysis
Executive dashboard	Presents structured, summarized information about aspects of business important to executives.	Status of sales by product
Supply chain management system	Manages flows of products, services, and information among organizations.	Walmart Retail Link system connecting suppliers to Walmart
Electronic commerce system	Enables transactions among organizations and between organizations and customers.	www.dell.com

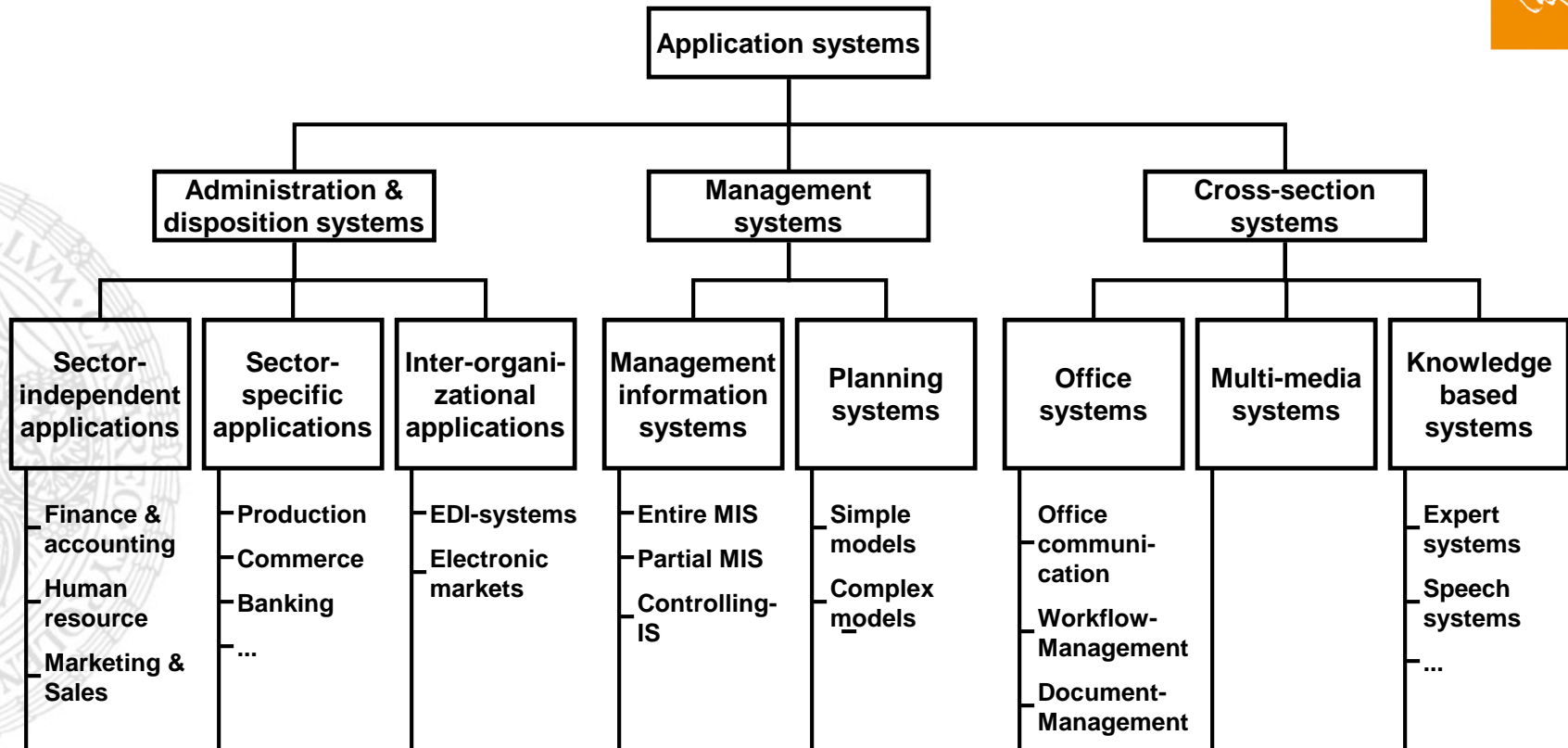
(Source: Rainer et al. , 2014, p.20)

Classification of Software

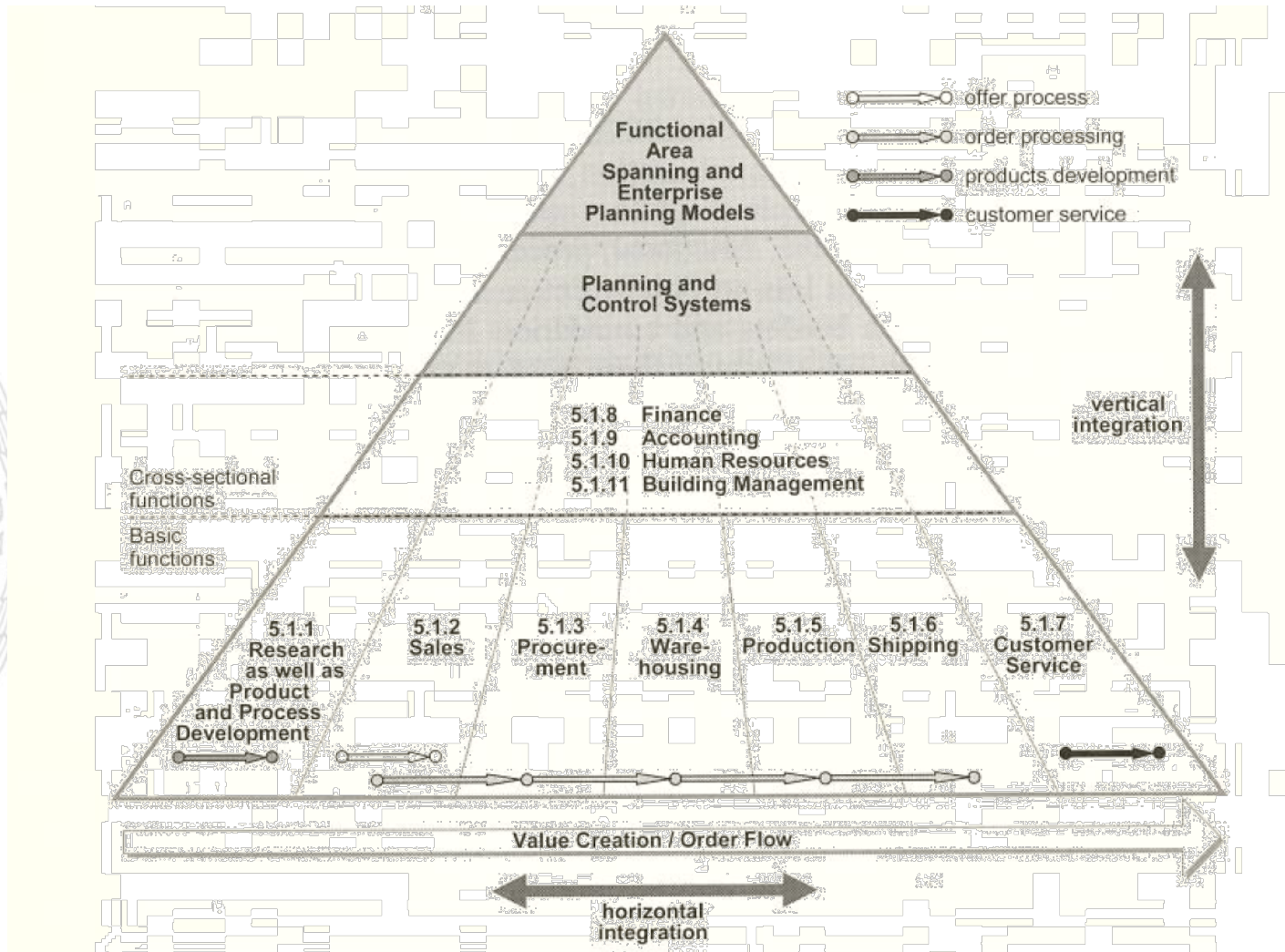


after: Wigand et al. 2003, p. 20

Classification of Business Application Systems

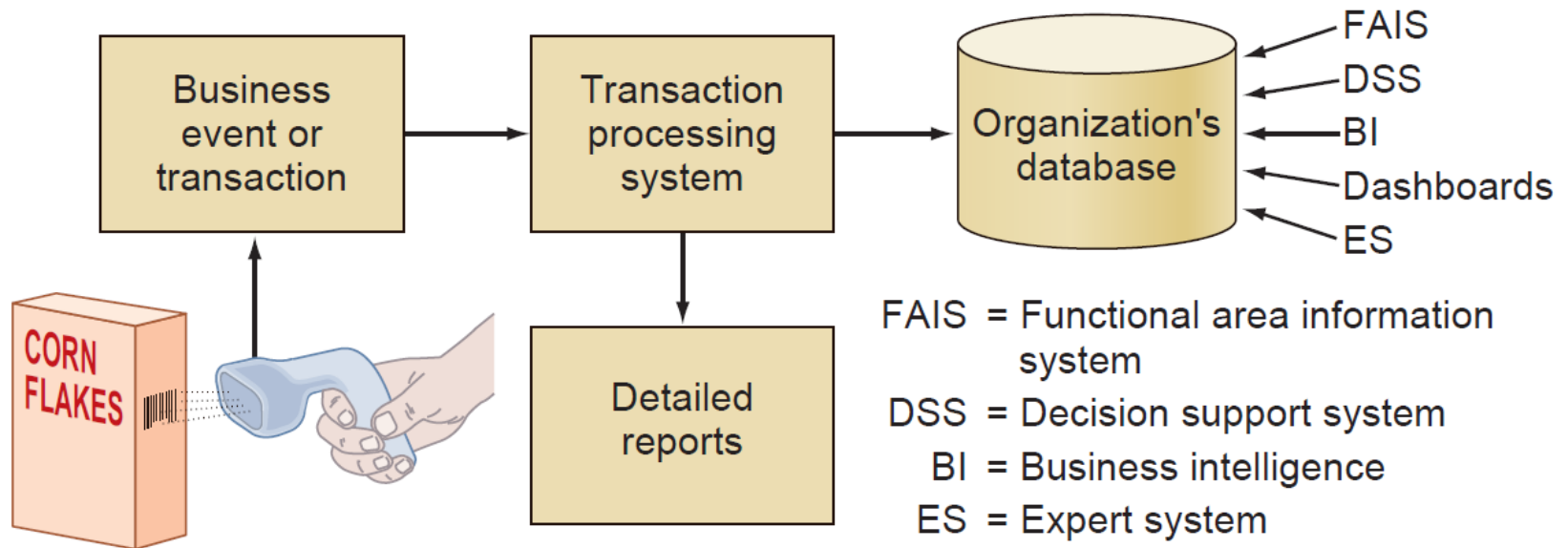


Integration



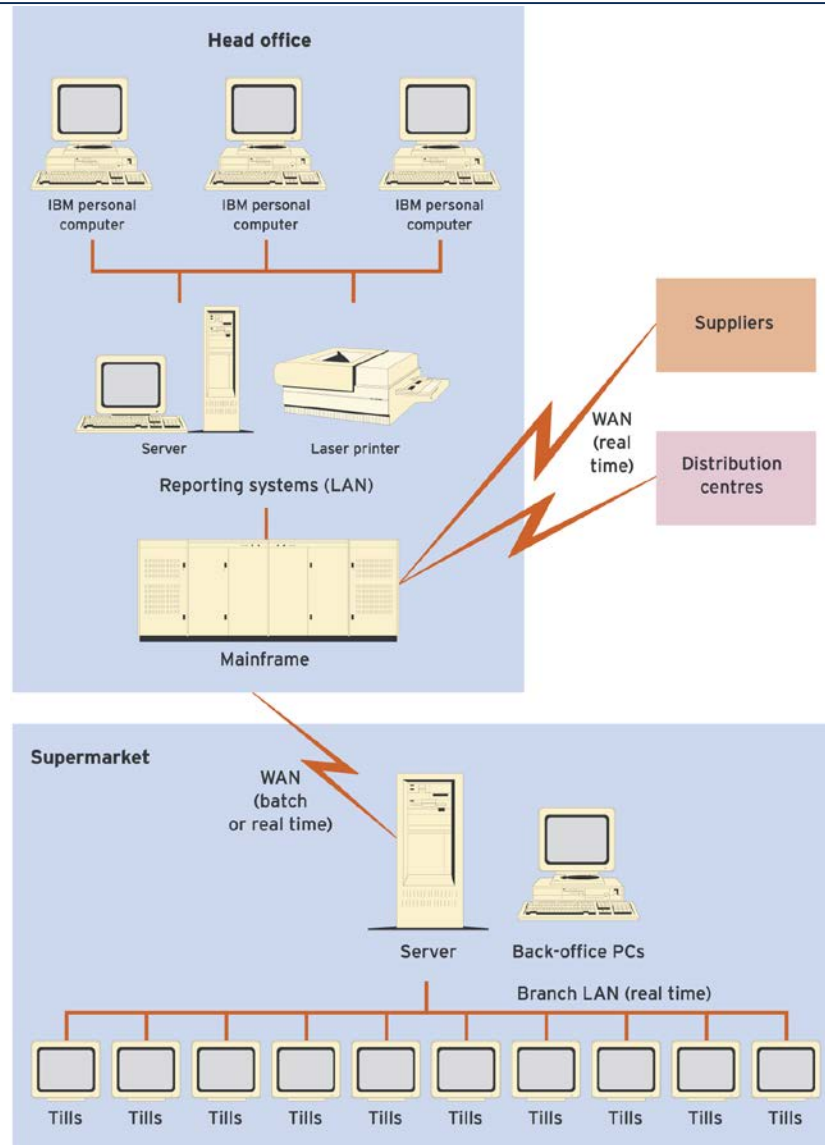
source: Wigand et al. 2003, p. 80

Transaction Processing System (TPS)



(Source: Rainer et al. , 2014, p.317)

TPS: Network Architecture



source: Bocij et al. 2015, p. 235

Office Automation Systems (OAS)



- OAS: Intention to increase the productivity of office workers
 - Integrated packages containing a number of components
 - Commercial versus open source
 - Client versus Web application
- Types:
 - Office suites
 - Collaboration systems
 - Enterprise Document and Content Management Systems (EDMS)
 - Enterprise knowledge infrastructures

source: cf. Bocij et al. 2015, p. 236

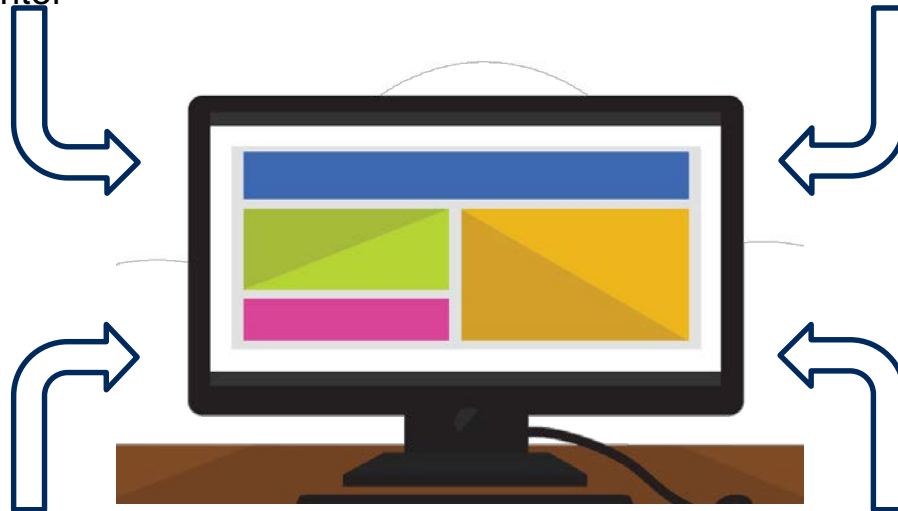
Typical Components of Integrated Office Systems

Text processing:

e.g., Corel WordPerfect, Google Docs, ThinkFree Wordprocessor, MS Word, OpenOffice Writer

Calendar:

e.g., Google Calender, MS Outlook



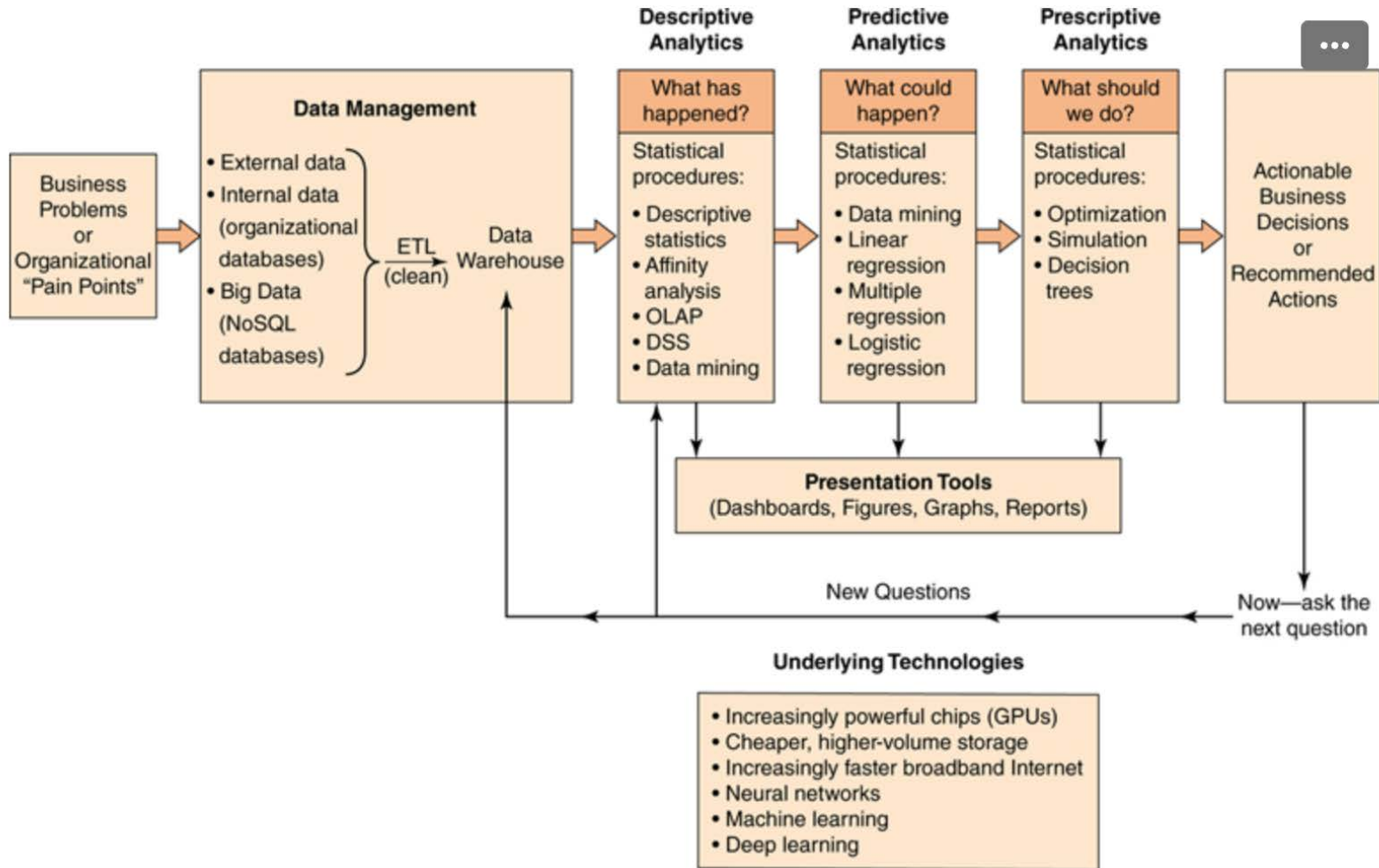
Spreadsheets:

e.g., Corel QuattroPro, Google Docs, MS Excel, OpenOffice Calc, ThinkFree Spreadsheet

Presentation:

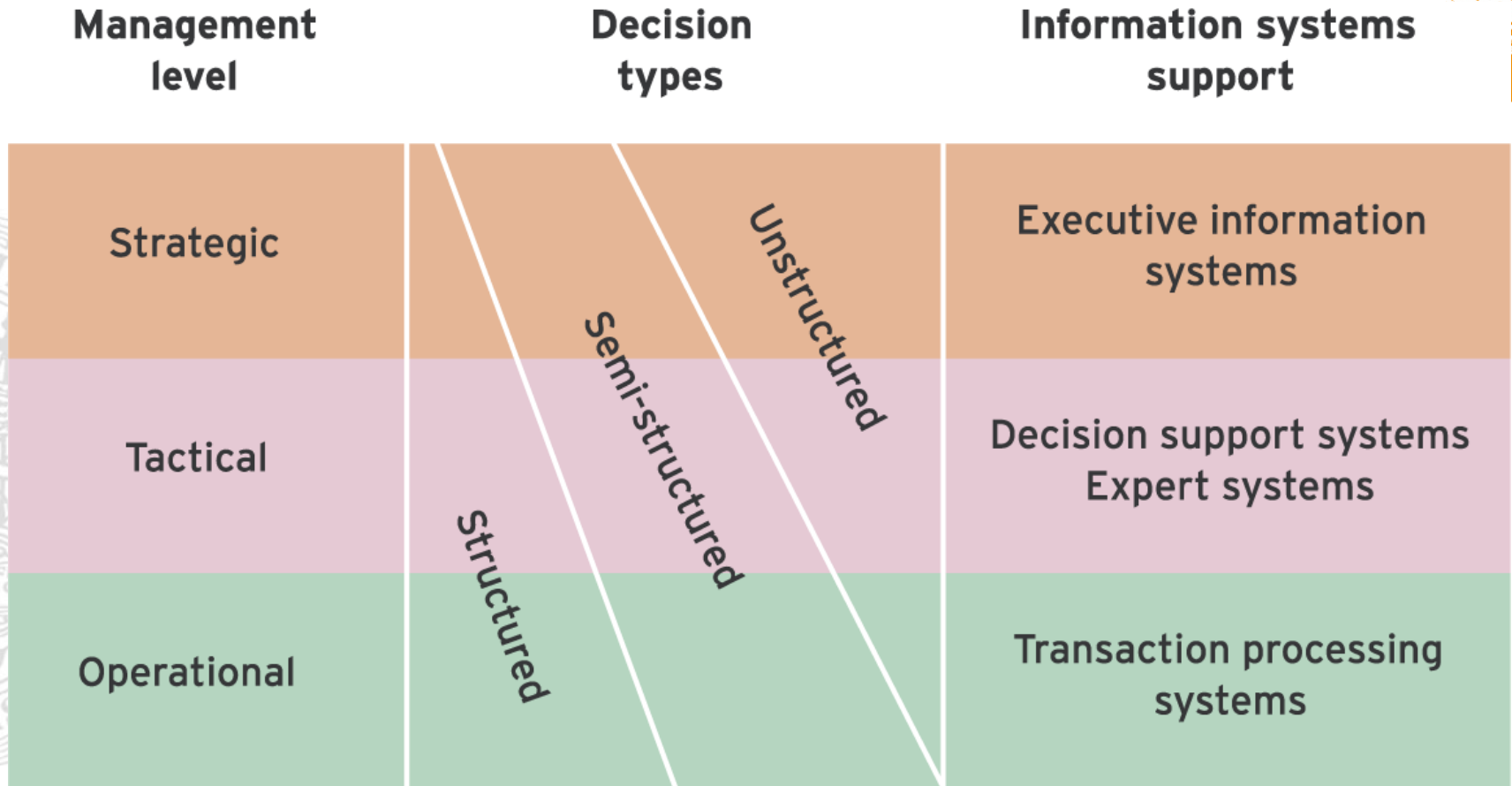
e.g., ThinkFree Presentation, Corel Presentations, Google Docs, MS Powerpoint, OpenOffice Impress

Business Analytics



(Source: Rainer et al. , 2019)

MIS: Classification



source: Bocij et al. 2015, p. 246

DSS: Decision Support System Components



- Dialogue (user interface):
 - used for achieving interaction with the user (formulate queries and models, review results),
 - trade-off between simplicity and flexibility,
 - simplicity needed since some managers may not be frequent DSS users,
 - flexibility required to allow a range of different questions and to enable data to be displayed in different ways.
- Data:
 - data collected from a range of sources
 - e.g., operational systems (for sales performance), financial accounting systems (for financial performance), internal documents or those available on the Internet.
- Model:
 - provides analysis capability for the DSS,
 - e.g., a financial model predicts for given inputs what the future profitability of a company will be if it continues on present course.

source: Bocij et al. 2015, p. 247

Information Reporting Systems (IRS)



- Periodic reports:
 - predefined reports required by decision makers at regular intervals,
 - e.g., a monthly financial statement and a weekly sales analysis.
- Exception reports:
 - reports produced only when required.
 - can be generated automatically when a performance measure moves outside a predefined range, e.g., sales falling below a certain level and customers exceeding their credit limits.
 - can be generated manually when a decision maker does not want to wait until the next scheduled periodic report or the information is only occasionally required.

source: Bocij et al. 2015, p. 249

Executive Information Systems (EIS)



- EIS provide senior managers with a system to assist them in taking strategic and tactical decisions:
 - Online Analytical Processing (OLAP): Refers to the ability to analyse in real time the type of multidimensional information stored in data warehouses.
 - Data warehouses: Large database systems containing detailed company data on sales transactions which are analysed to assist in improving the marketing and financial performance of companies.
 - Data marts: These are small-scale data warehouses which do not aim to hold information across an entire company, but rather focus on one area, e.g., sales or operations.
 - Data mining: An attempt to identify relationships between variables in data warehouses in order to assist decision making.

source: Bocij et al. 2015, p. 250

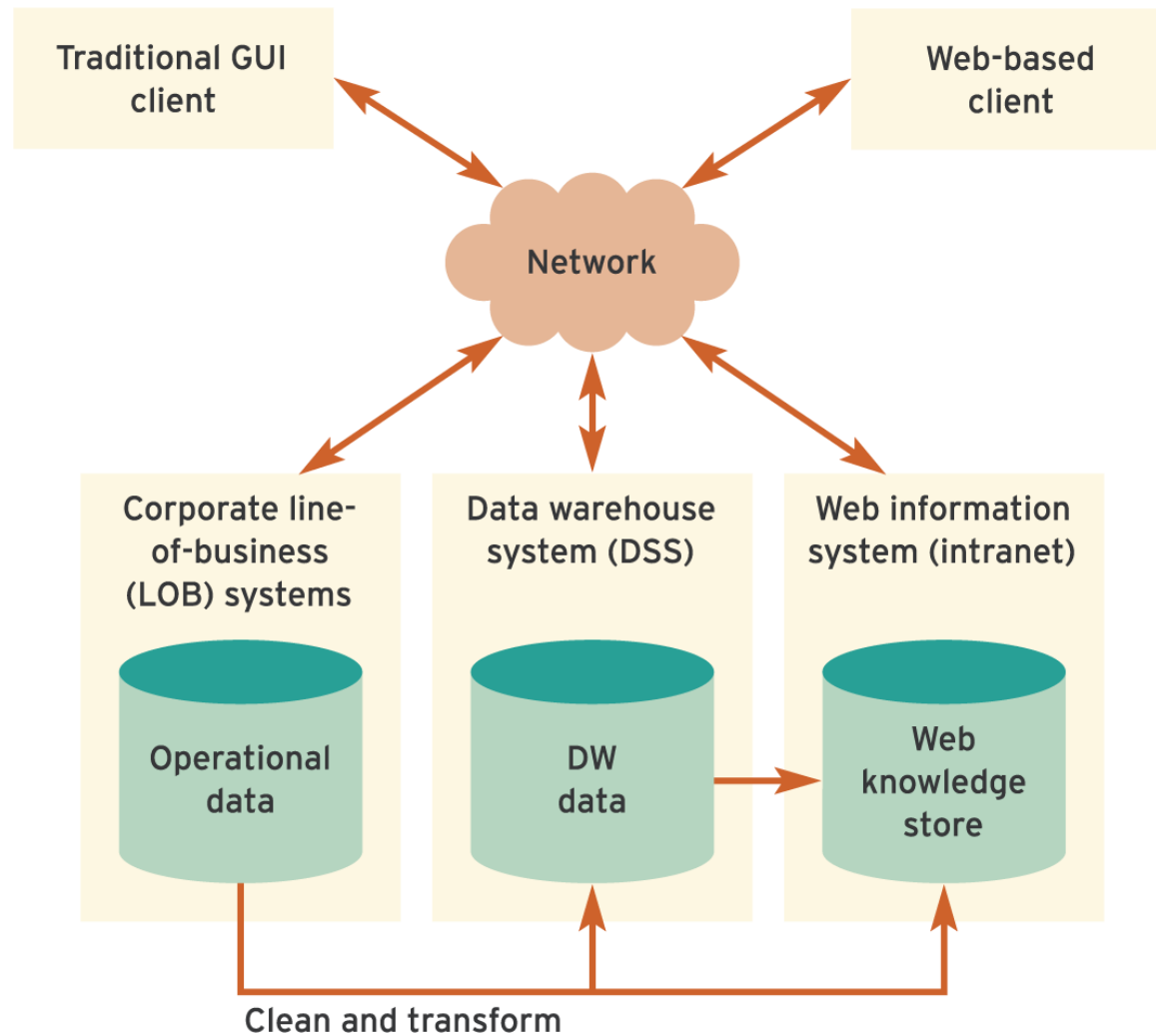
Definition Data Warehouse



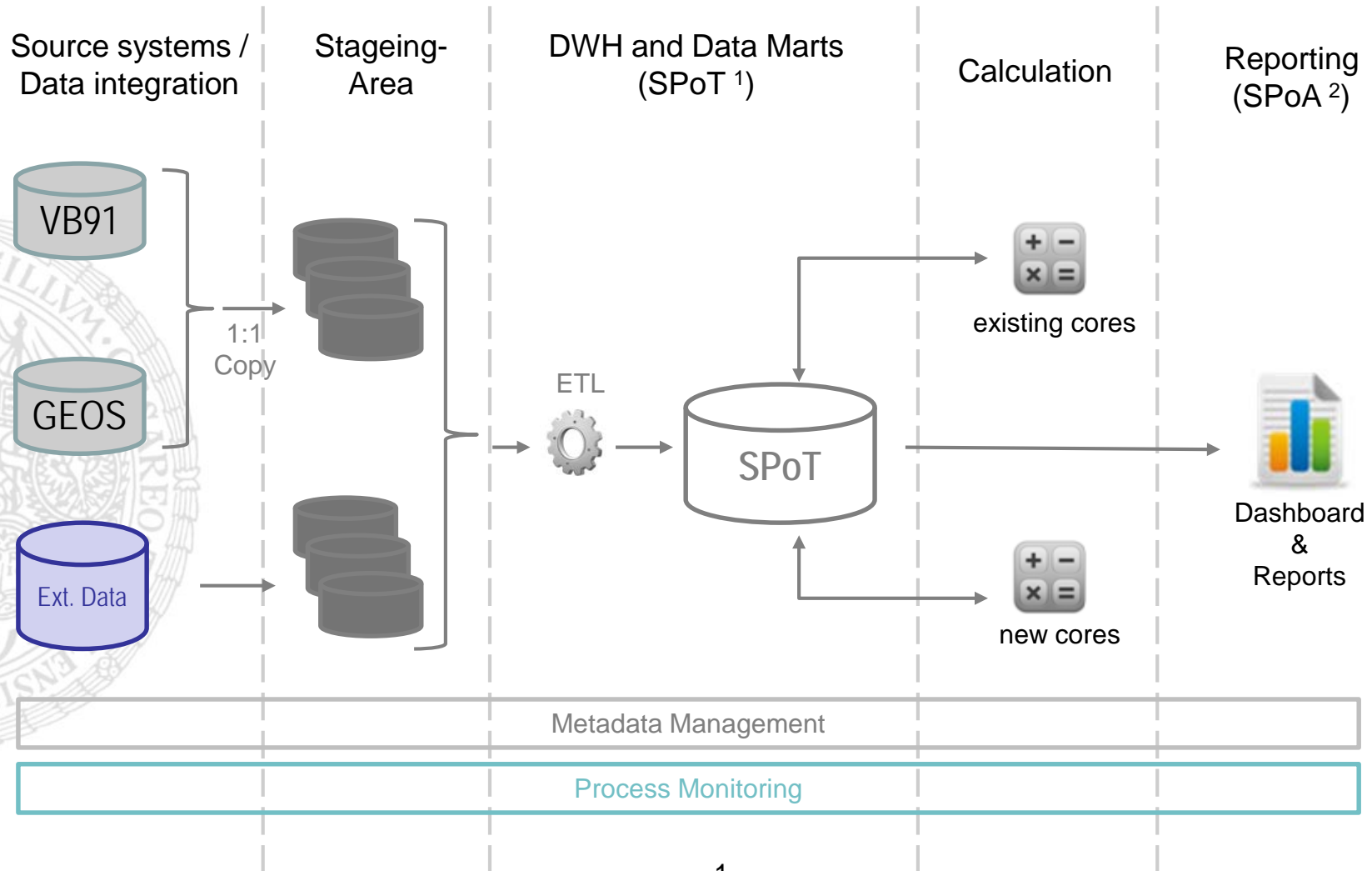
- A Data Warehouse is a
 - subject-oriented,
 - integrated,
 - time-variant,
 - non-volatile
- collection of data
- in support of management's decisions
- A special data base system that draws data from multiple, heterogeneous data sources

source: Inmon

EIS: Data Warehouse Architecture



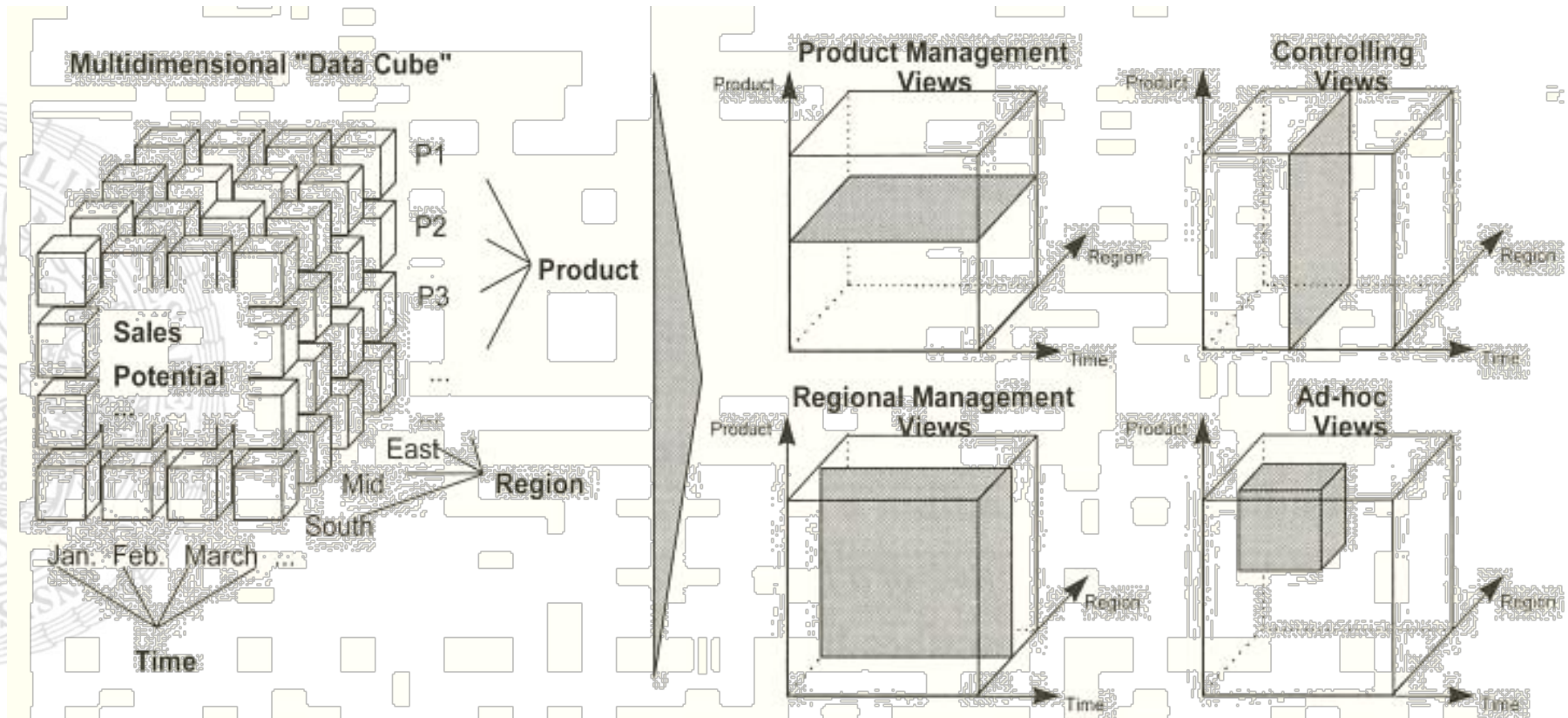
Architecture of a Data Warehouse



¹ Single Point of Truth
² Single Point of Access

source: Klotz 2015

Different Views on OLAP Cubes (Multidimensional Analyses)



source: Wigand et al. 2003, 74

A Strategic Perspective on Business Applications



- **Business information strategy:** defines how information, knowledge and applications portfolio will be used to support business objectives.
- **Applications portfolio:** range of different types of business applications deployed within an organisation
- **IS strategy:** determines most appropriate processes and resources to ensure that information provision supports business strategy
- **IS functionality strategy:** requirements for e-business services delivered by the applications portfolio
- **IT strategy:** determines most appropriate technological infrastructure comprising software, hardware and network standards and suppliers which make up the e-business infrastructure

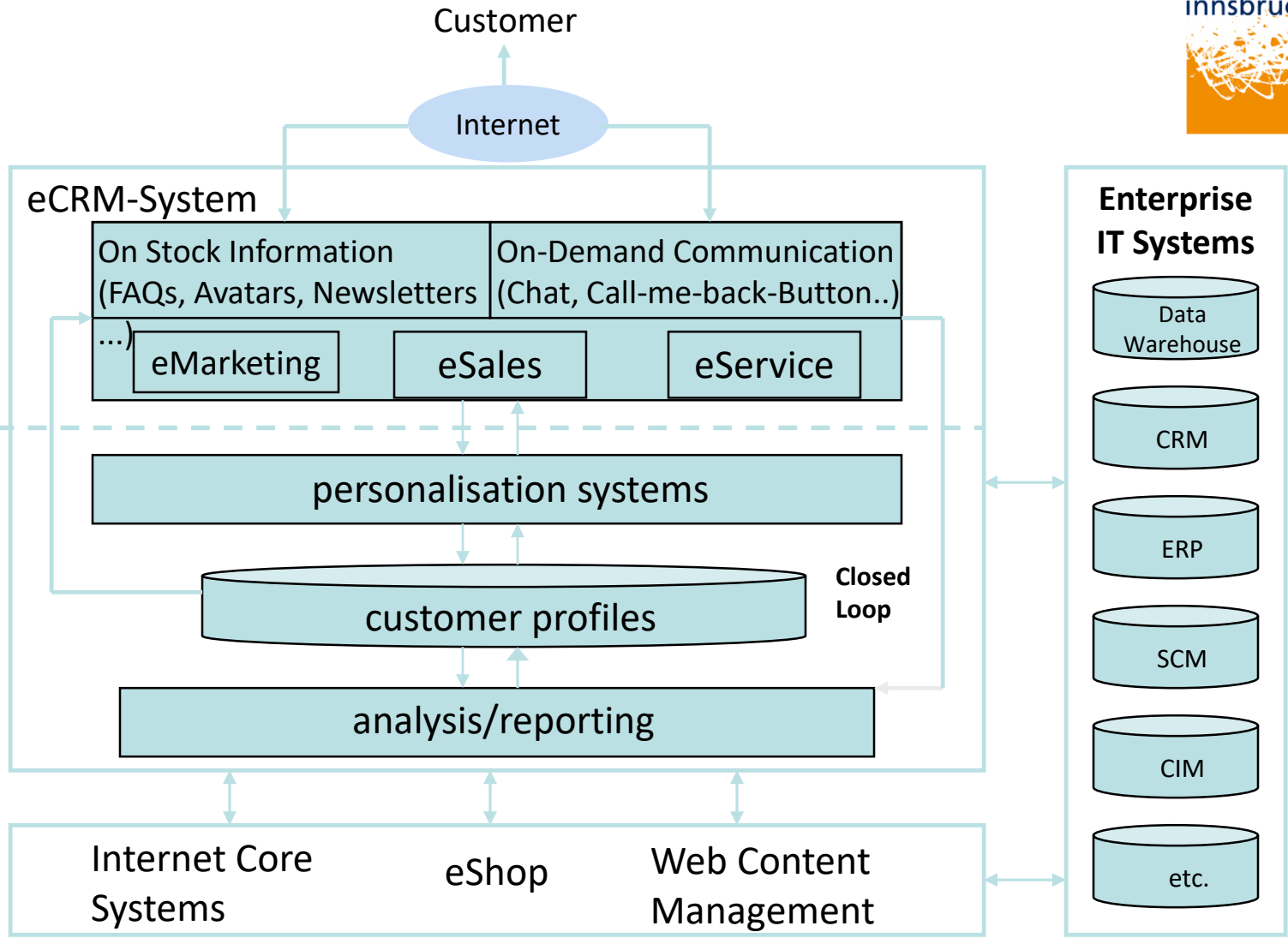
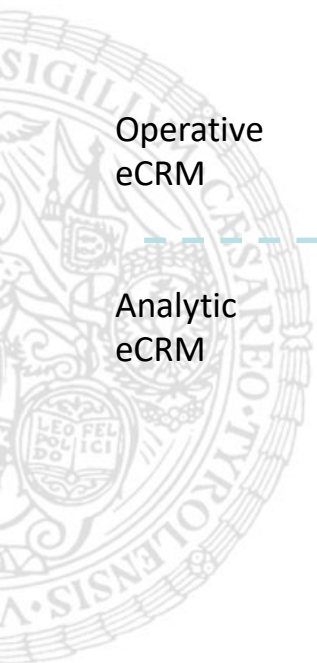
Business Application Systems in the Industry Sector



- Product Development
- **e.g. Marketing and Sales** -> CRM
- Procurement
- Warehousing
- Production -> CIM, MRP, Throughput Scheduling, CAM
- Shipping
- Customer Service
- Finance and Accounting
- Human Resource Management
- Facility Management

IS for functional area:

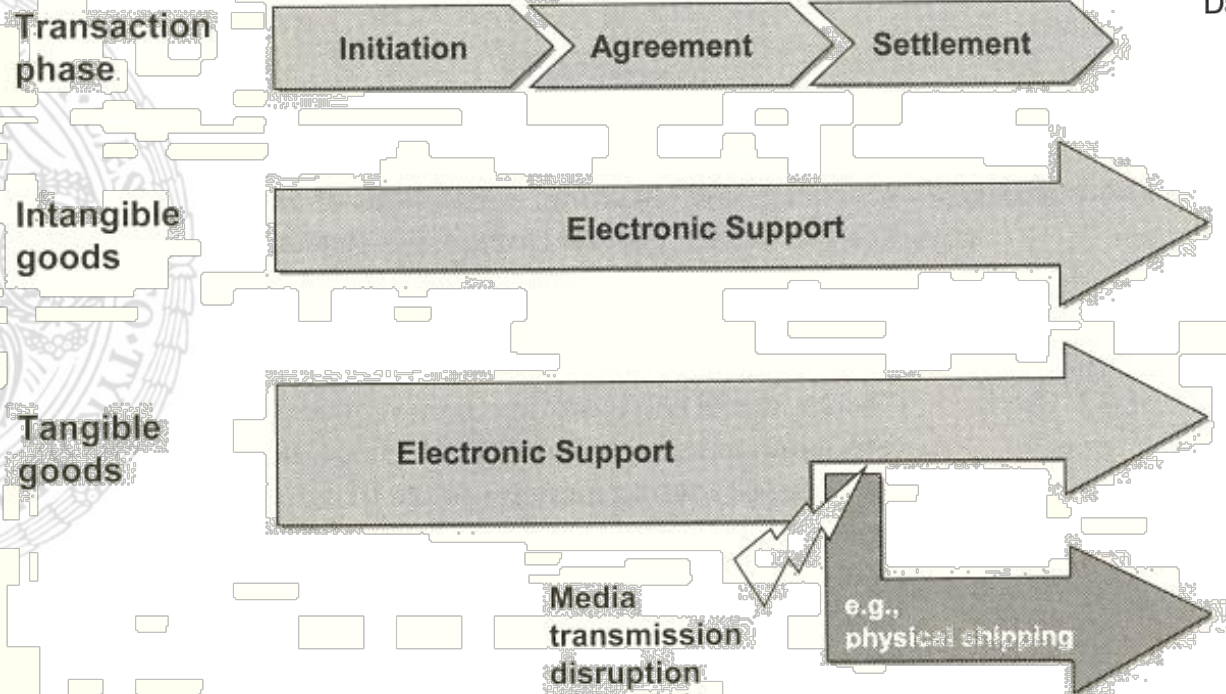
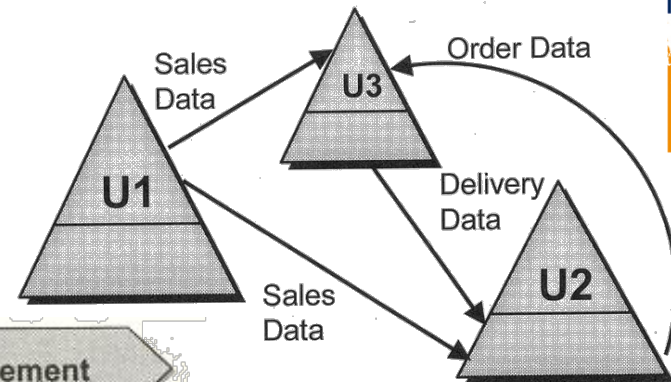
- Example Architecture of a CRM System



source: Bruhn/Stauss, Electronic Services, 2001, p.542

Business Application Systems for E-Commerce

- Inter-organizational (process) integration
- Transaction phases and their support



- Supply Chain Management

source: Wigand et al. 2003, 162

Examples of ICT Support for Transaction Phases

<i>Phase</i>	<i>Sub-Task</i>	<i>Support</i>
Initiation	Public Relations	Website, WCMS, social software
	Advertising	Newsletter, viral marketing
	Product catalogue	Website with database connection
	Consultation	Video conferencing, FAQ, recommender systems, avatars
Agreement	Product configuration	Online configuration system
	Ordering	Web forms, XML, Electronic Data Interchange (EDI)
Execution	Delivery	Downloading digital products
	Payment	Digital money, smartcards, electronic payment systems
	Customer Support	Web help desk, Frequently Asked Questions (FAQ), forums

after: Wigand et al. 2003, 162

- Standard software is software which was developed for an anonymous market, meaning a potentially large number of users. Therefore, it was developed explicitly considering re-use by different users.
- In contradiction, individual software is always developed for one specific user.
- Relates to make or buy decision,
- Application bundles for business applications versus standard software in the area of system software, office bundles, ...
- Integrated application bundles for business processes versus application bundles for a differentiated area (e.g., accounting)
- Sector-independent vs. sector-specific standard software

What is ERP?



- supported by **multi-module** application software
- helps organisations to **manage the important parts of its business**, including product planning, materials and parts purchasing, maintaining inventories, operations, interacting with suppliers, providing customer service, and tracking orders.
- ERP can also include application modules for the **financial** and **human resources** aspects of a business.
- Typically, an ERP system uses or is **integrated with a relational database system**.
- The deployment of an ERP system can involve **considerable effort, e.g., for business analysis, employee retraining, and new work procedures**.

Key Attributes of an ERP

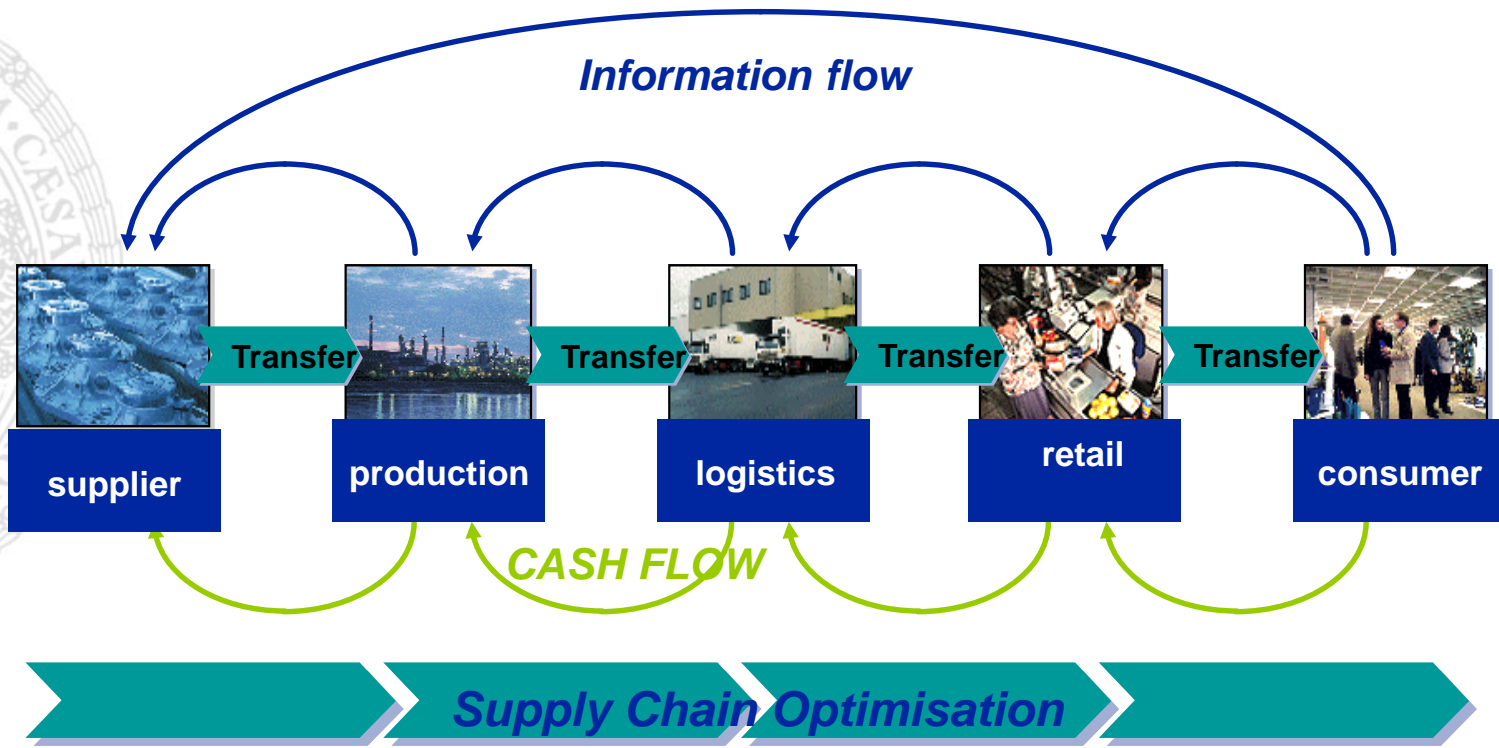
Automate and integrate the majority of an organization's processes.

Share common data and practices across the entire enterprise.

Produce and access information in a real-time environment.

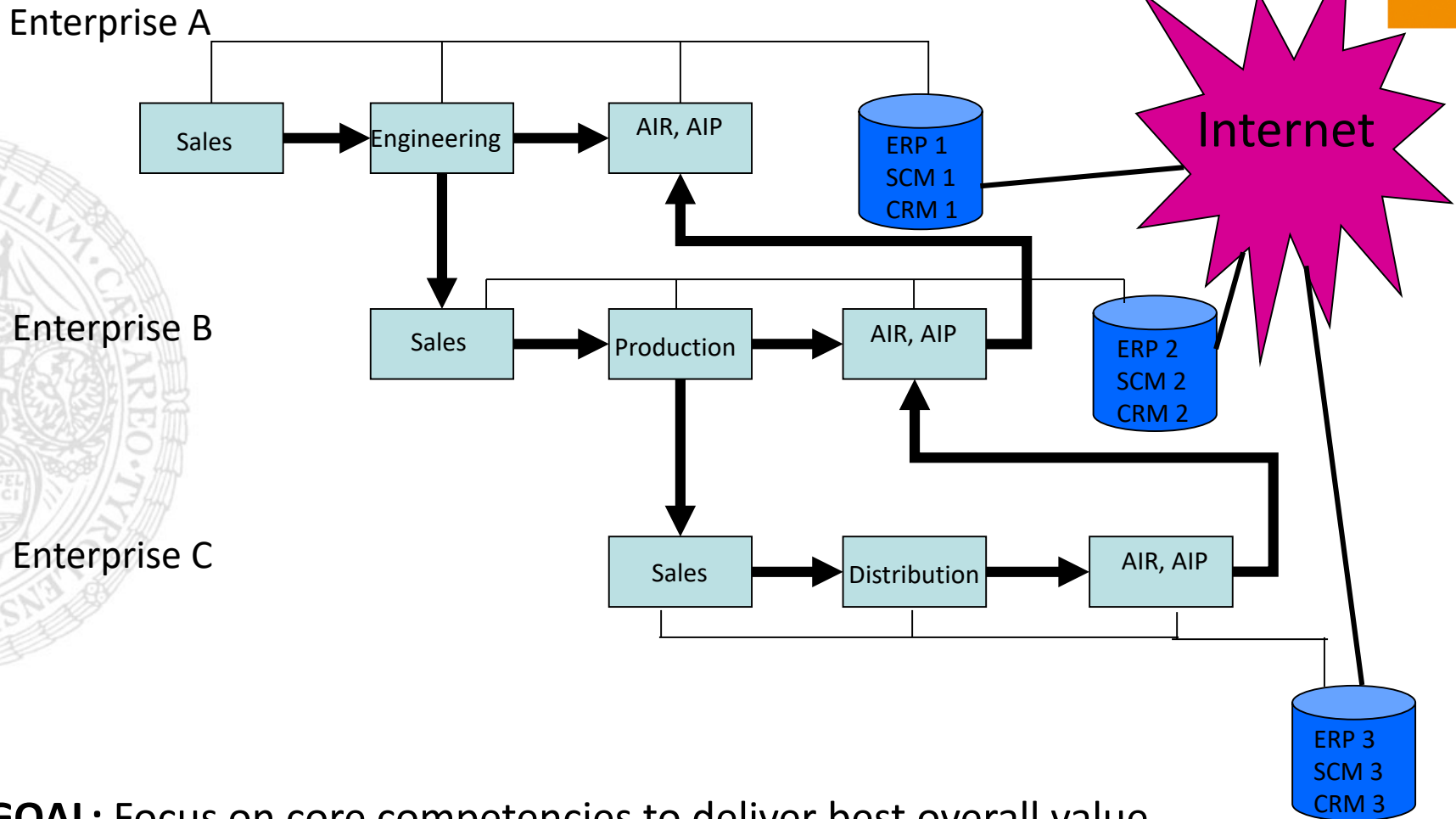
ERP and Business Processes

- integrates most business functions
- integrates external and internal processes



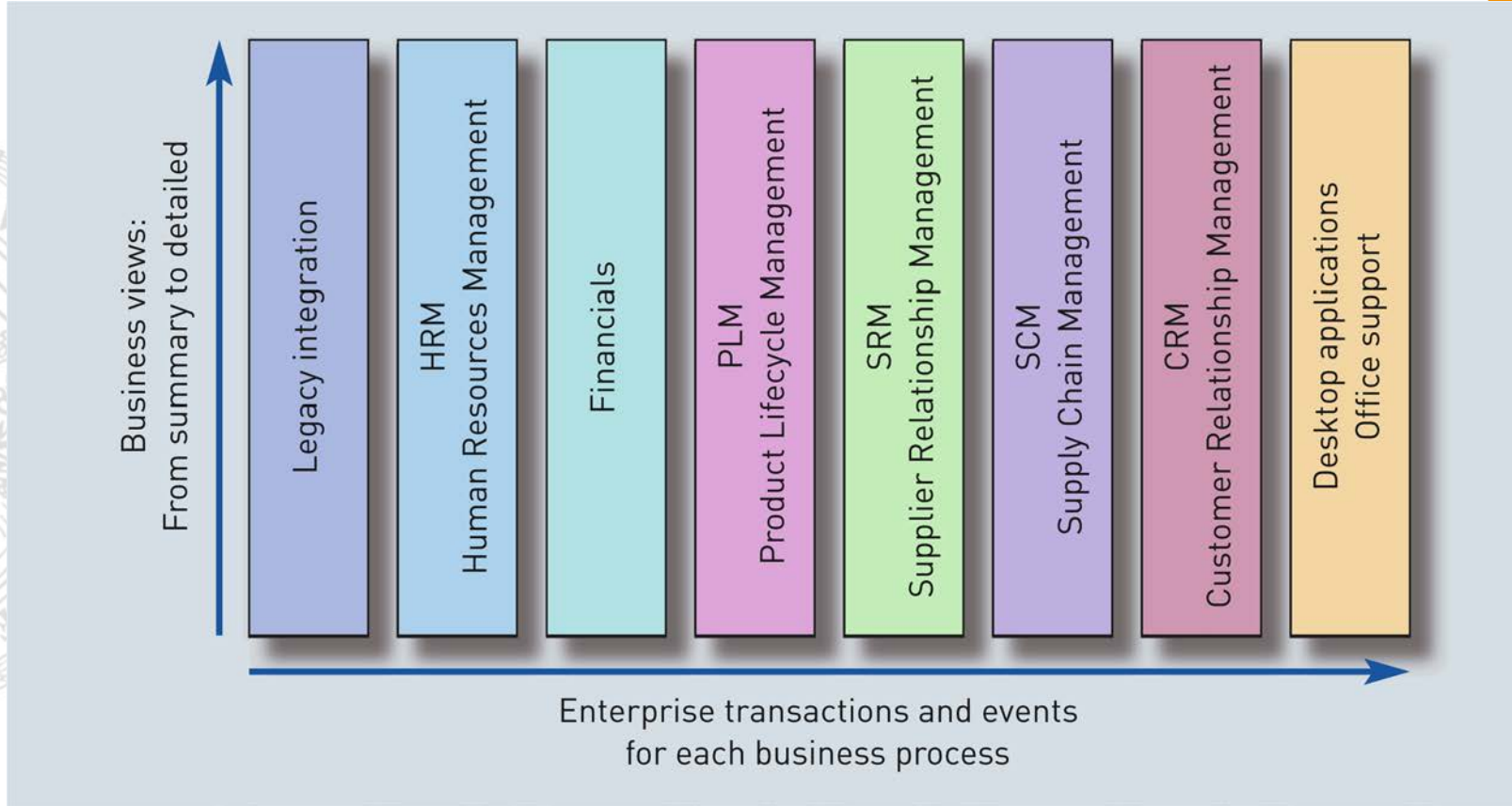
Aim: Optimizing Business Processes Across Enterprises

“Inter- Enterprise Processes”



GOAL: Focus on core competencies to deliver best overall value

Source: M. Kirchmer, IDS Scheer, Inc



ERP Application

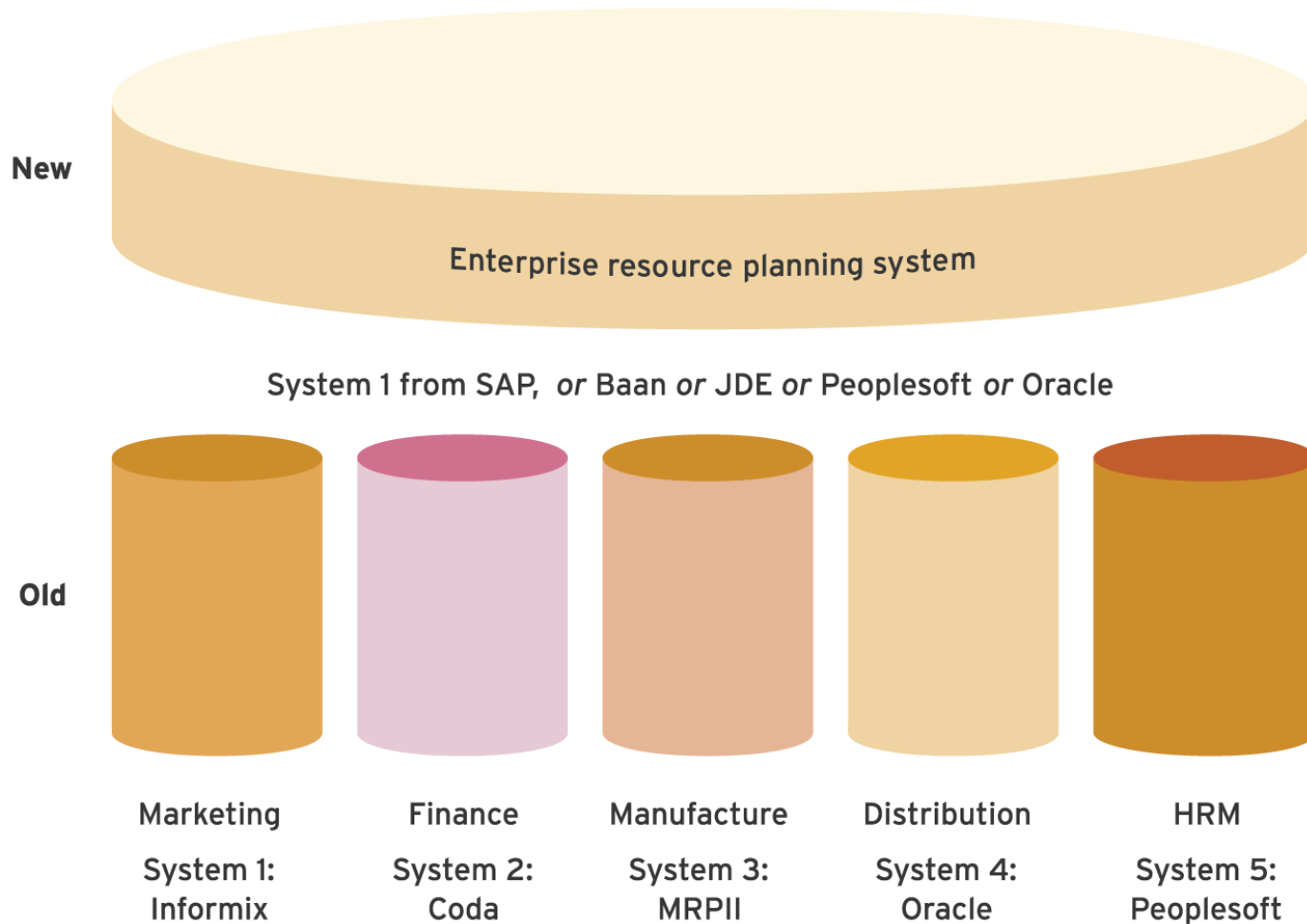
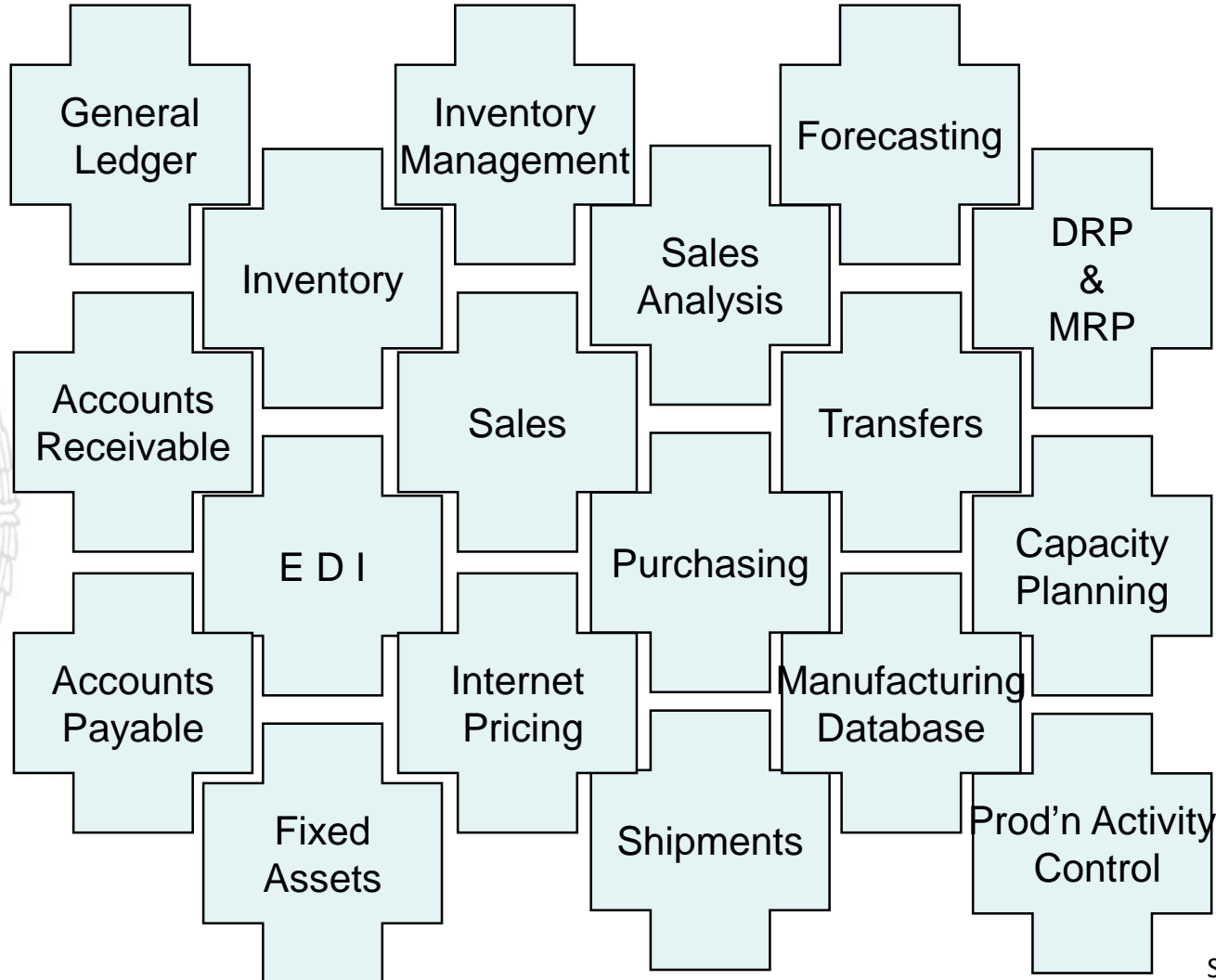


Figure: ERP application in comparison to separate functional applications

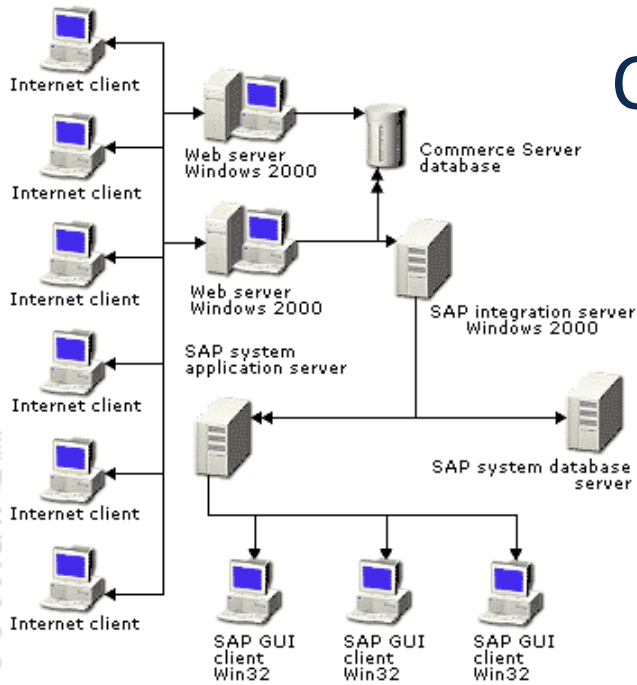
source: Bocij et al. 2015, p. 50

ERP : Integrated Modules – “Ideal”: Everything in One Self-Contained System



Source: Deloitte 2004

Complexity of ERP Systems



13.000.000 users
8.000 developers
10 locations (for development)
100.000.000 lines of code
190.000 functional components
100.000 screens
34.000 DB tables
30.000 reports
2.500 interfaces to other software

Financials	General Ledger		Payments	Cost Accounting	Funds Management	
Logistics	Sales	Internet Sales	Procurement	Warehouse Management	Manufacturing	Project Management
Customer Relationship Management	Contact Management		Opportunity Management	Pipeline Management	Service Management	
Business Intelligence	Predefined Reports		Analysis instruments		Drag & Reiate	

Project duration: 6 months -> several years

source: Kagermann, SAP 2003

Examples for Integrated Business Solution Vendors



- **SAP** (Systems, Applications, & Products in Data Processing)
 - ECC 6.0, All-in-One, Business One
- **Oracle Applications**
 - Oracle, JD Edwards, PeopleSoft, Siebel, Retek
- **Microsoft Business Solutions**
 - Dynamics: Great Plains, Navision, Axapta, Soloman
- **The Sage Group**
 - Sage Software - Accpac ERP, PeachTree
- **Infor**
 - Infor10 ERP Enterprise
- **Many Others**

A Brief History of ERP Solutions by SAP



mySAP ERP 2005

Budget Alerts - Microsoft Outlook

Subject	Received	Status	Monitored Cost Obj
Posting to Internal Order: Suppl...	Monday, 4/25/2005 9:31 AM	Active	Supplies (2833)
Variance greater than 10% on Inter...	Monday, 4/25/2005 9:30 AM	Active	Alpha (1357)
Posting greater than \$3,500 to Inte...	Monday, 4/25/2005 9:30 AM	Active	Contractors (5938)
Posting greater than \$1,200 to Cost...	Monday, 4/25/2005 9:30 AM	Active	Bonuses (8229)
Variance greater than 5% on Intern...	Friday, 4/23/2005 11:07 AM	Expired	Lightspeed (1380)
Variance greater than 5% on Intern...	Friday, 4/23/2005 9:30 AM	Expired	Lightspeed (1380)
Posting to Internal Order: Suppl...	Thursday, 4/22/2005 9:30 AM	Active	Supplies (2833)
Posting to Internal Order: Travel exc...	Tuesday, 4/20/2005 9:30 AM	Processing	Travel (4000)
Posting to Internal Order: Travel exc...	Friday, 4/16/2005 7:00 AM	Processing	Travel (4000)

Variance greater than 10% on Internal Order: Alpha (1357)
Mendocino Budget Alerts
To: Stavo, John

On Friday, April 23, 2005, the variance on Internal Order: Alpha (1357) satisfied the conditions for the rule "Variance greater than 10%" and triggered this alert.

Budget information for Internal Order: Project A (12345)
Plan: \$38,750.00 USD
Actual: \$47,800.00 USD
\$ Variance: \$9,050.00 USD
% Variance: +23.3%

Plan vs. Actual trend for Internal Order: Project A (12345)

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Actual	23,500	24,000	25,000	25,500	26,000	28,500	9,800	31,000	34,000	35,250	49,800

SAP ERP 7.0

Corporate Account: ADCOM Computer / Seattle WA 98155

Save | Cancel | New | Show Duplicates | More v

Contacts

Actions	Name	Function	Department	Phone/Ext.	E-Mail
	Andrew Sands	Director	Sales Operations	(206) 724-5490	andrew.sands@sap_adcom.com
	Julia Hunt	Sales Representative	Sales Operations	+1 (206) 724-5580	julia.hunt@sap_adcom.com
	Kevin Harper	Sales Representative	Sales Operations	+1 (206) 724-5605	kevin.harper@sap_adcom.com

Attachments

Acti...	Name	Type	Created By	Created On	Mime Type
	Service Order Confirmation	PDF File (Adobe Acrobat Exchange/Reader)	BAXTER	11/28/2007 13:17	application/pdf
	Forecast Sheet	MS Excel File	BRIGHT	06/27/2006 17:27	application/vnd.ms-excel
	Adcom Web Site	URL	BRIGHT	06/27/2006 17:27	text/plain

Planned Activities

Actions	Transaction ID	Start Date	End Date	Description	Category	Status	Contact	Person Respo...
	212	11/29/2007	11/29/2007	Prepare ADCOM Jour ...	Task	Open	Andrew Sands...	Lou Windham / ...
	1246	11/29/2007	11/29/2007	Prepare Follow-up Me...	Task	Open	Andrew Sands...	Richard Baxter...
	1321	11/29/2007	11/29/2007	Get Feedback and Cla...	Task	Open	John Taylor	Richard Baxter...

Opportunities

Actions	Description	Closing Date	Employee Resp...	Sales Stage	Status	Expected Sales ...	Crcy	Main Contact
	New HPath 4000 for H...	04/02/2007	Alex Bright / Denv...	Quotation	In process	140,000.00	USD	Andrew Sands / ...
	Lead from Customer Gr...	05/01/2007	Chris Fastabend / ...	Solution Develop...	Open	1,500,000.00	USD	Andrew Sands / ...
	Notebooks 1f3	06/30/2007	Alex Bright / Denv...		In process	5,500,000.00	USD	Andrew Sands / ...

Marketing Attributes | **Interaction History**

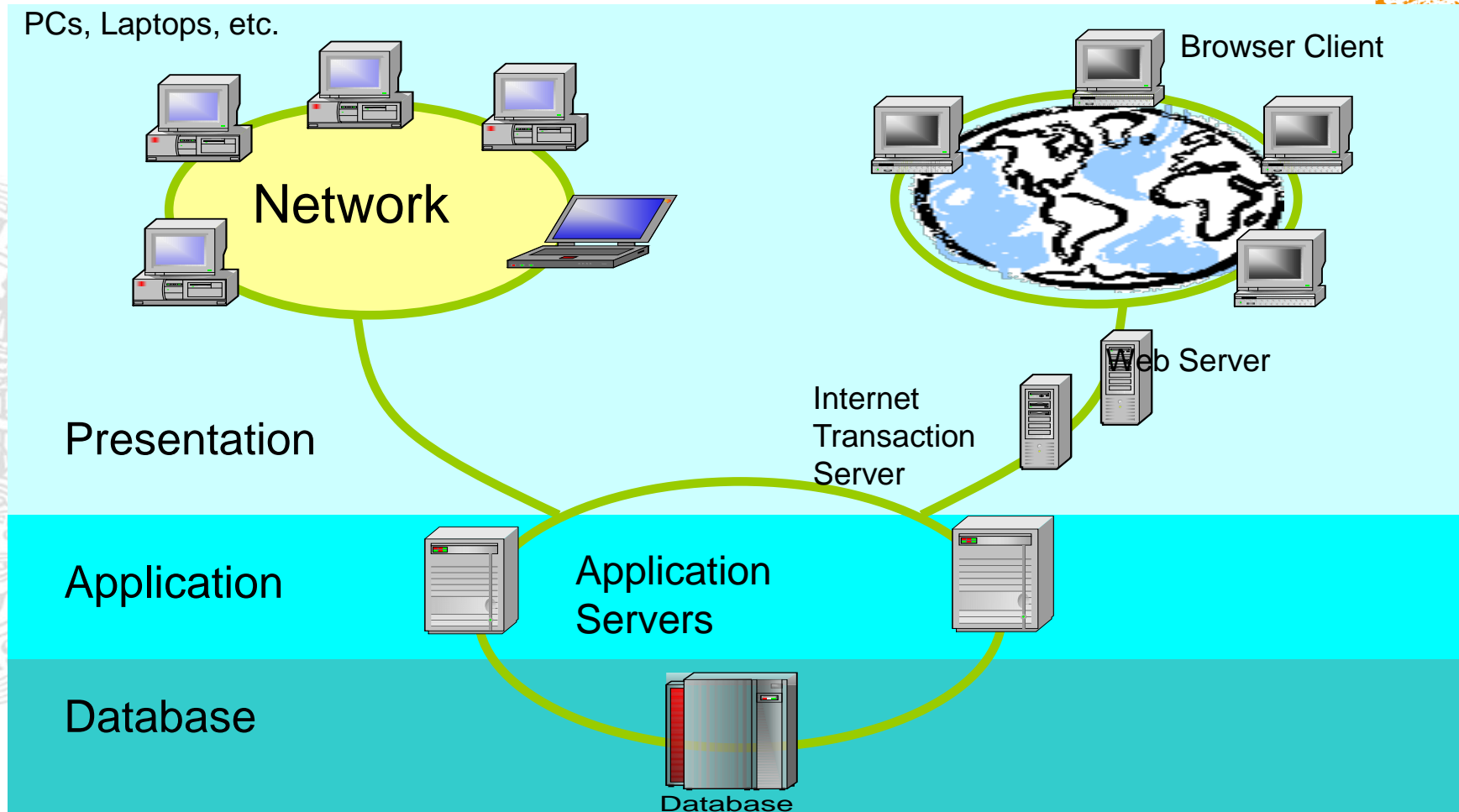
SAP: Industry Solutions



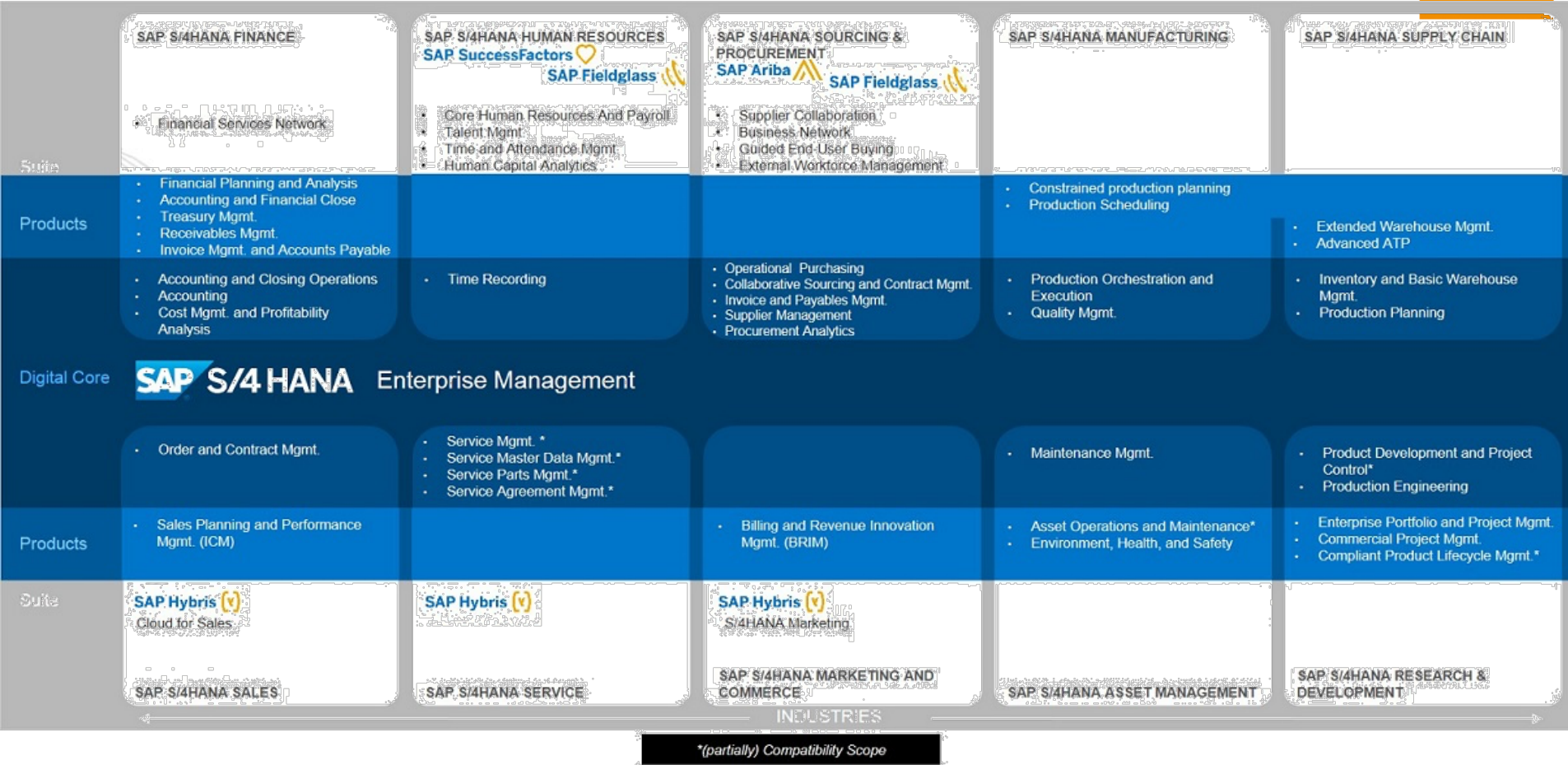
- Aerospace & Defense
- Automotive
- Banking
- Chemicals
- Consumer Products
- Defense & Security
- Engineering, Const.
- Healthcare
- High Tech
- Higher Education
- Industrial Machinery
- Insurance
- Life Sciences
- Logistics Service Prod.
- Media
- Mill Products
- Mining
- Oil & Gas
- Pharmaceuticals
- Postal Services
- Professional Services
- Public Sector
- Railways
- Retail
- Telecommunications
- Utilities
- Wholesale Distribution

2007, The Rushmore Group, LLC

SAP Architecture




SAP S/4HANA Overview



INDUSTRIES
*(partially) Compatibility Scope

Source: SAP 2017

SAP Revenue Breakdown 2016



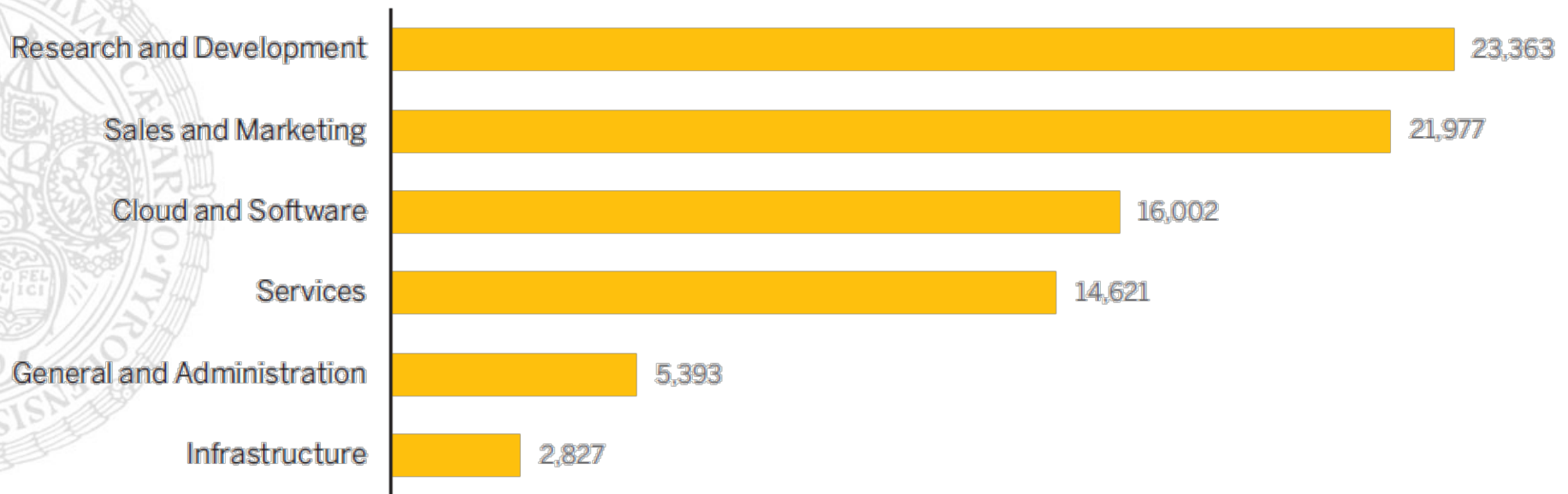
Revenue measures	Million €
Cloud subscriptions and support	2,993
Software licenses	4,860
Software support	10,571
Software licenses and support	15,431
Cloud and software	18,424
Services	3,638
Total revenue	22,062

source: SAP Annual Report 2016, p. 5

SAP Employees by Functional Area (FTEs)

Employees by Functional Area

Full-Time Equivalents



source: SAP Annual Report 2016, p. 92

Why packaged Standard Software?



- Fragmentation of data and functions
- Old complex legacy systems, being continuously enhanced (e.g., Y2K problem, introduction of Euro, international accounting standards, business analytics and reporting, compliance)
- Incorporated best practices (ECommerce, CRM, SCM)
- Cost pressure

Advantages of ERP Systems



- is cheaper (in the long run, if used close to standards)
- is available and implementation is relatively fast
- offers higher quality because of incorporating best practices
- enables cross-company integration
- saves own IT resources (especially human resources)
- offers support by SW supplier
- reduces dependency on SW developers

Disadvantages of ERP Systems

- requires customizing efforts
- introduction costs are 8-10 times as high as with individual SW
- often shows performance problems (universal programming)
- possibly needs solving of interface problems
- cannot meet all requirements
- development know-how is not built up
- shortage of staff experienced with ERP systems

Issues with ERP

- high costs →
 - individual developments are expensive, too
 - no costs for developers
 - no programming of interfaces between modules
 - quick introduction methodology (ASAP, ReadyToWork)
- expensive consultants →
 - no developers any more
 - strategy + technical consulting results in benefits beyond ERP
- difficult to recruit new staff →
 - several educational partners
 - distribution of know-how is higher
- too complex →
 - business is complex
 - heterogeneous solutions are complex, too
 - several measures, user interface...

[after: Kleinschmidt: SAP R3 in der Praxis, University of Passau 2000]

- *Possible approaches:*

1. Adaptation of the real business processes to the ERP system
2. Adaptation of the ERP system to the real business processes
3. Compromise of 1. and 2.
4. Optimizing of real business processes + compromise of 1. and 2. and, possibly, adherence to standards, e.g., ISO 9000
5. Hybrid approach (choose “best-of-breed” modules from several vendors)

- large cut into existing business processes
- user acceptance?
- loss of profile
- cheapest solution with regard to introduction & release changes
- often together with new HW upgrades
- often for non-core processes

Adaptation of ERP System to Real Business Processes



- close to traditional individual SW development
- high adaptation efforts
- high efforts when upgrading/changing releases
- high efforts when synchronizing data structures
- keeping the organisation's profile

Optimizing Real Business Processes, Compromise of 1. & 2. and possibly Adherence to Standards (e.g., ISO)



- using ERP introduction to optimize business processes
- optimization is done by simultaneously considering real business processes and those implemented in the ERP systems
- ISO certification: Align real and ERP business processes, requirements for optimization, and ISO requirements e.g., for quality management, (information) security management, risk management

- **Configuration**
 - only needed components are used,
 - approach: selection, test regarding logic and feasibility, generation of standard software,
- **Parameterization**
 - desired program functions are initialized by setting of parameters,
 - SAP ERP: interpretive approach: parameters inserted into a DBS via a customizing transaction
- **Modification**
 - change of existing components,
 - SAP ERP: uses ABAP (Development Workbench),
- **Individual programming**
 - customizations or extensions are realized by self-developed components,
 - SAP ERP: by User Exits.

Why upgrade?

- Use functional enhancements
- Get relief from vendor-imposed support deadlines
- Reduce customizations and extensions
- Consolidate instances
- Keep options for SOA releases
- Synchronize tools and infrastructure releases

Why not upgrade?

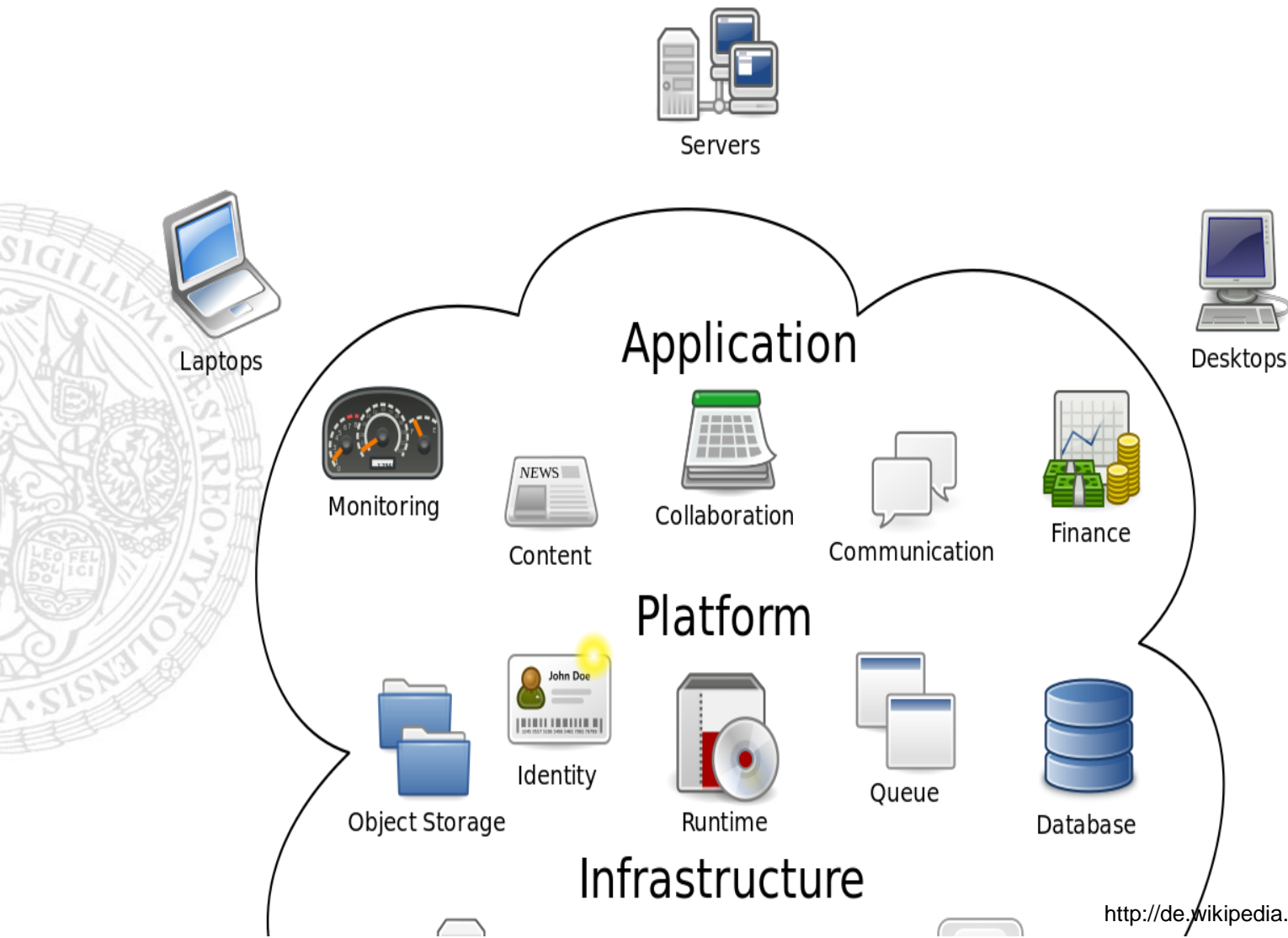
- Applications are mature, enhancements not compelling
- Costs and availability of resources
- Too many customizations and extensions
- Support services are not providing value
- Cheaper support alternatives available
- Plan to switch to another vendor

ERP Systems – Some Thoughts about the Future



- ERP is and will be the main software to run businesses
- **customize less** and reduce over time
- **delay upgrades** as long as possible
- more **industry solutions**
- **reengineering of ERP packages** with the help of new programming languages and architectures (Java, SOA, Net Weaver, HANA) to enable more flexibility
- intra to **cross-organisational solutions** (SCM, ECommerce, etc.)
- **market consolidation**
- **open source** ERP packages
- service provisioning (**ASP, SaaS, cloud**) for ERP systems and as a consequence new business models
- **GRC components:** governance, risk, compliance, security

Cloud Computing



http://de.wikipedia.org/wiki/Cloud_Computing

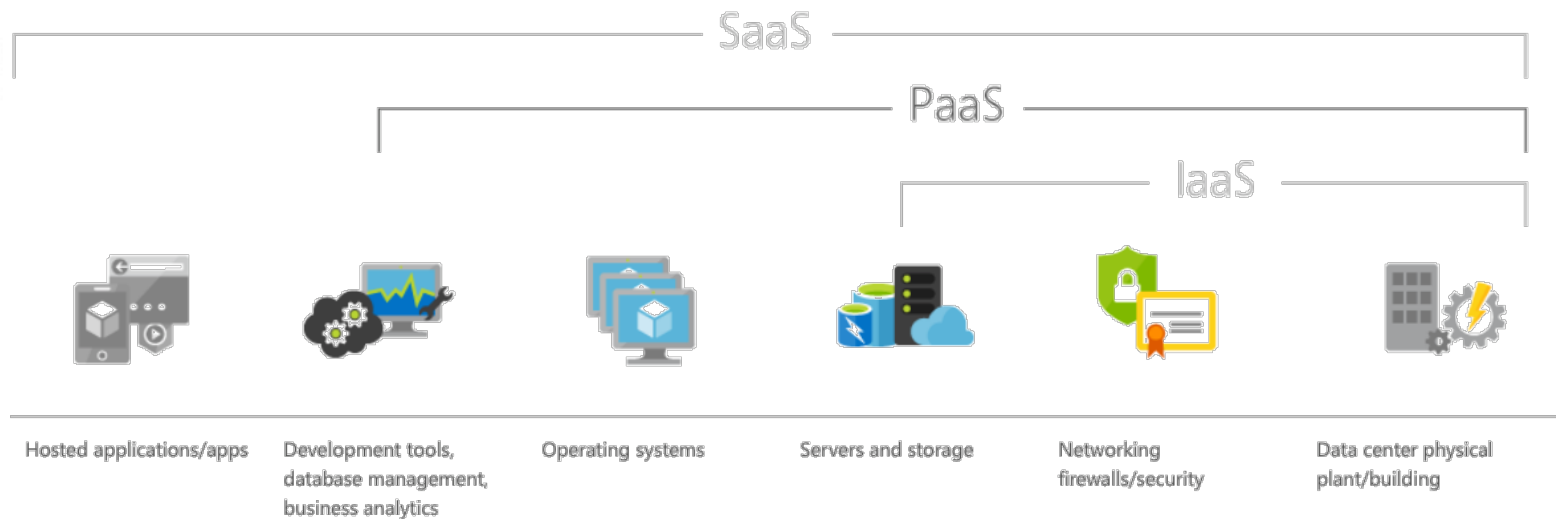
Types of cloud computing

ON-PREMISE SOFTWARE	INFRASTRUCTURE-AS-A-SERVICE	PLATFORM-AS-A-SERVICE	SOFTWARE-AS-A-SERVICE
<p>CUSTOMER MANAGES</p> <ul style="list-style-type: none"> Applications Data Operating system Servers Virtualization Storage Networking 	<p>CUSTOMER MANAGES</p> <ul style="list-style-type: none"> Applications Data Operating system <p>VENDOR MANAGES</p> <ul style="list-style-type: none"> Servers Virtualization Storage Networking 	<p>CUSTOMER MANAGES</p> <ul style="list-style-type: none"> Applications Data <p>VENDOR MANAGES</p> <ul style="list-style-type: none"> Operating system Servers Virtualization Storage Networking 	<p>VENDOR MANAGES</p> <ul style="list-style-type: none"> Applications Data Operating system Servers Virtualization Storage Networking
Examples	Amazon, IBM, Google, Microsoft, Rackspace	Mircosoft Windows Azure, Google App Engine, Force.com	Salesforce.com, Google Apps, Dropbox, Apple iCloud, Box.net

(Source: Rainer et al. , 2014, p.20)

Everything as a Service (XaaS)

- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Software as a Service (SaaS)



source: Microsoft Azure 2017

Everything as a Service – IaaS



Infrastructure as a service (IaaS) is a

- standardized, highly automated offering of
 - computing resources
 - storage
 - networking capabilities
- owned and hosted by a service provider
- offered to customers on-demand
- self-provision of infrastructure via Web-based graphical user interface
- API access to the infrastructure

Examples: Amazon Web Services, Cisco Metapod, Google Compute Engine, etc.

source: Gartner 2017b

Everything as a Service – PaaS



Platform as a Service:

- complete development and deployment environment in the cloud
- Like IaaS, PaaS includes infrastructure (servers, storage, networking, middleware, development tools, business intelligence services, database management systems)
- purchase resources from cloud service provider on a pay-as-you-go basis
- Support of complete web application lifecycle: building, testing, deploying, managing and updating
- avoid expense and complexity of buying and managing software licenses, underlying application infrastructure and middleware or development tools and other resources.

Examples: IBM Managed Platform as a Service, Microsoft Azure, etc.

source: Microsoft Azure 2017

Everything as a Service – SaaS



Software as a Service:

- software that is owned, delivered and managed remotely by one or more providers
- provider delivers software based on one set of common code and data definitions
- consumed as one-to-many model by all contracted customers at anytime
- pay-for-use basis or as a subscription based on use metrics

Example: Microsoft's Office Web Apps, etc.

source: Gartner 2017c

Forecast Global Cloud Market Share

Table 1. Worldwide Public Cloud Services Forecast (Millions of Dollars)

	2016	2017	2018	2019
Cloud Business Process Services (BPaaS)	40,812	43,772	47,556	51,652
Cloud Application Infrastructure Services (PaaS)	7,169	8,851	10,616	12,580
Cloud Application Services (SaaS)	38,567	46,331	55,143	64,870
Cloud Management and Security Services	7,150	8,768	10,427	12,159
Cloud System Infrastructure Services (IaaS)	25,290	34,603	45,559	57,897
Cloud Advertising	90,257	104,516	118,520	133,566
Total Market	209,244	246,841	287,820	332,723

Source: Gartner (Februarv 2017)

source: Gartner 2017d

Conclusion



- Business software **is** complex
- Design and deployment require knowledge about both, the business domain and the options for its representation/enhancement by IT
- Architectures, frameworks and structures help organizing components/modules/application systems
- Specifics to be found with respect to industry sector, business ecosystems, organisation type, organisation, esp. operational systems
- ERP systems typically standard solutions (with customization)
- Non-ERP software requires attention: collaboration systems, enterprise knowledge infrastructures, IS materializing competitive advantages, connectors to platforms (e.g., business, crowd, social media)
- Integration across organizational boundaries as well as with “things” in the physical environment (e.g., machines, tools, products)
- Increasingly comprehensive virtual representation of the physical organisational world

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