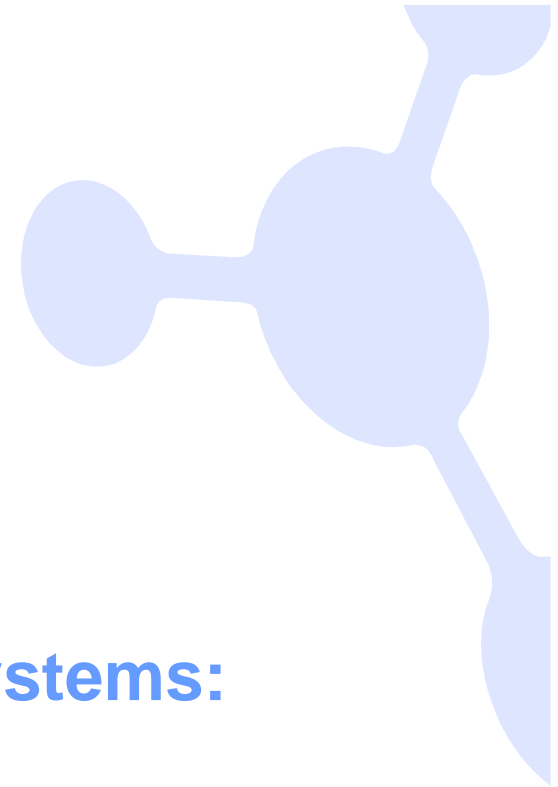




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Building Blocks of Inter-Organisational Systems: Part 1

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Institut für Wirtschaftsinformatik
Universität Münster



Objective

- What are (IT) building blocks for IOS?
- Visions and scenarios that have guided the development of IOS technologies.
- The role of standards.
- Generations and development trends of IOS technologies.

Agenda

A. Electronic Data Interchange (EDI)

B. Enterprise Application Integration (EAI)

C. Middleware

Agenda

A. Electronic Data Interchange (EDI)

1. The EDI concept
2. Message standards: XML-based standardisation activities
3. New EDI / Web-EDI

B. Enterprise Application Integration (EAI)

C. Middleware

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A. Electronic Data Interchange (EDI)

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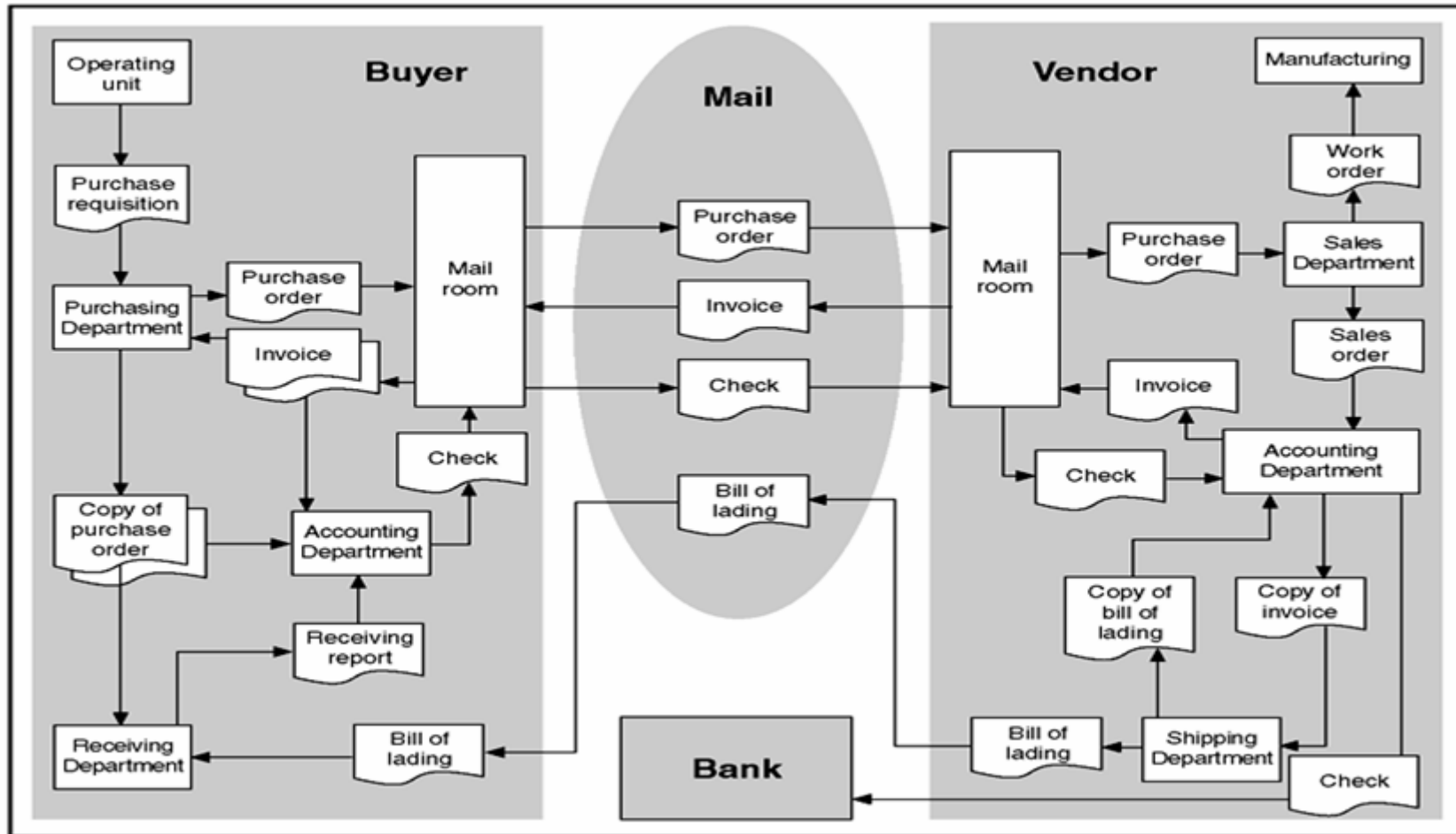
Types of communication

From \ To	Human	Computer/ Application
Human	E-Mail (File Transfer)	Interactive applications, On-line systems (CRS, electronic trading systems) E-Forms
Computer/ Application	Computer based control systems Automated E-Mail	EDI File Transfer

Why do we focus on EDI?

- EDI has been the dominant technological platform of IOSs.
- EDI encompasses most of the aspects that are relevant to IOS:
 - strategic (competitive advantage based on advanced ICT),
 - organisational (inter- and intraorganisational redesign) and
 - technical questions
 - standardisation issues

Motivation for EDI: Information Flows in the Paper-based Purchasing Process



The EDI vision ...

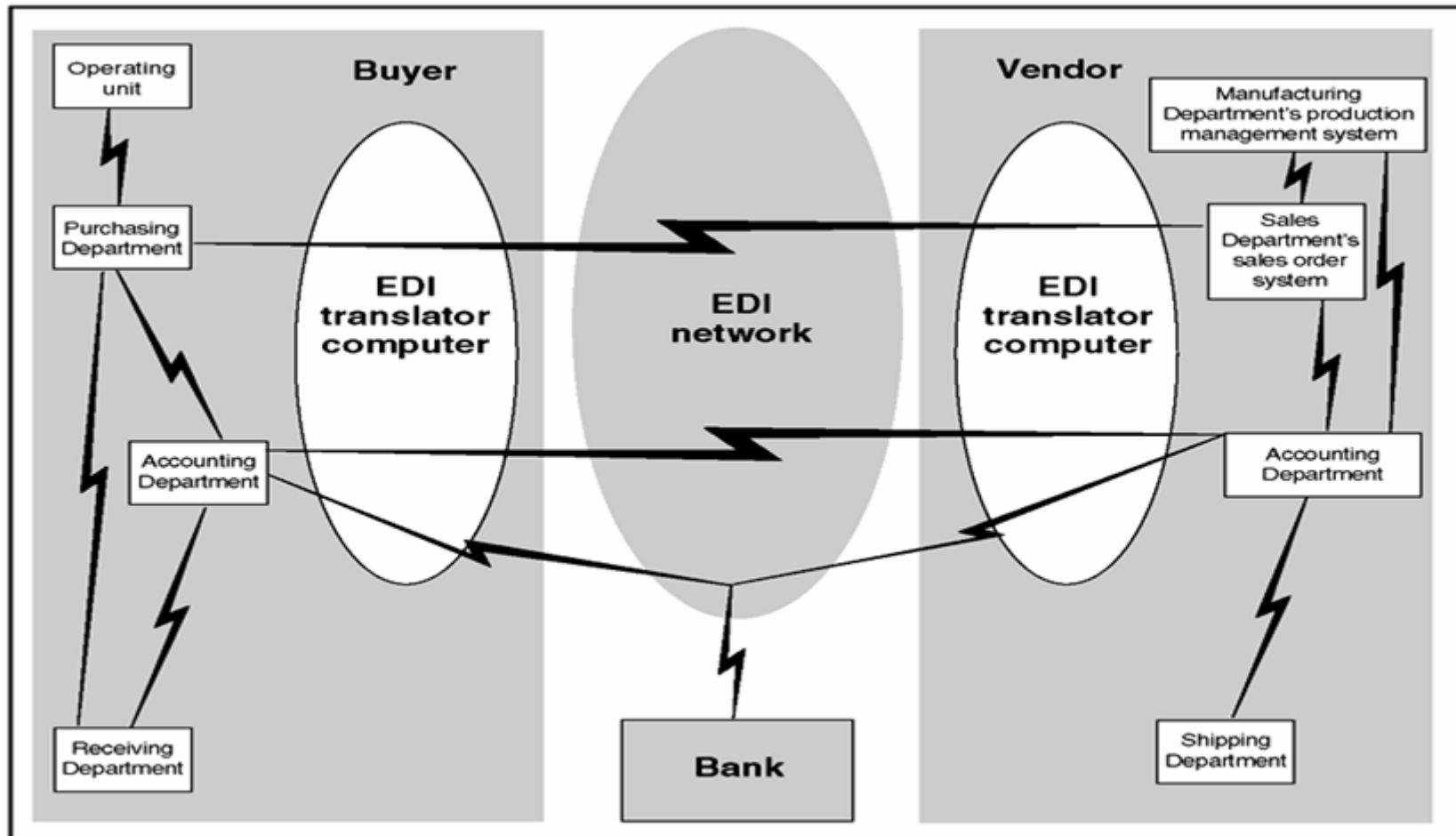
- Global,
- Intersectoral,
i.e. encompassing the private and the public sector,
- Standardised

business communication among applications.

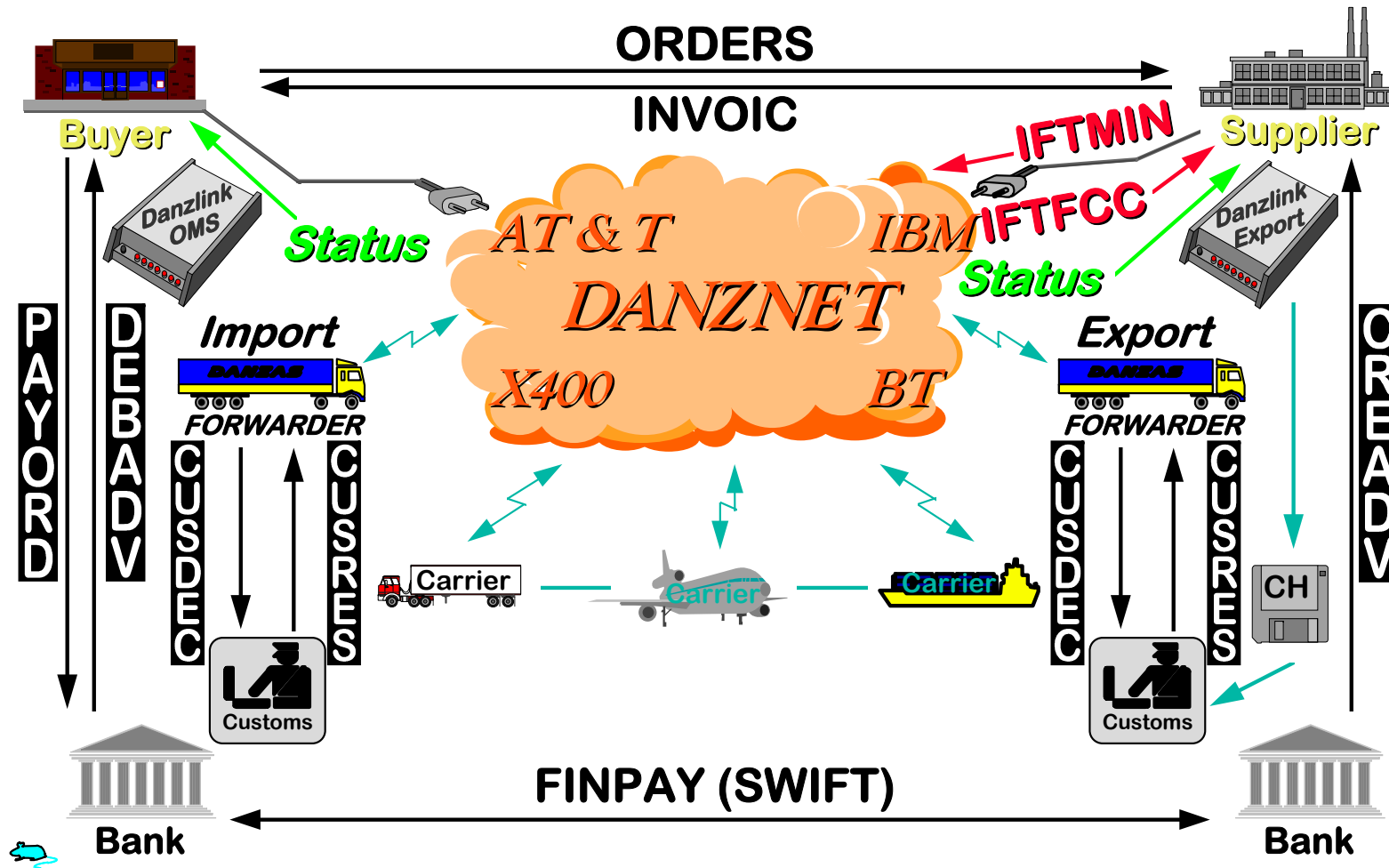
EDI application scenario

- ... automated exchange of standardised and structured business documents (messages for business transactions)
- extension of the notion of office automation across the boundaries of firms
- process integration for automatic order management, delivery or inventory management
- ideally with little or no human intervention: interpersonal communication is not envisioned
- applications in marketing (multi-media presentation) etc. are typically not part of EDI

Information Flows in the EDI Purchasing Process



EDI message flow (example DANZAS (now DHL))



[Source: DANZAS AG (now DHL)]

EDI ... a definition

<i>inter-organizational</i>	data exchange among legally independent companies, in particular trading partners and service providers
<i>electronic exchange of</i>	based on electronic communication media.
<i>standardized business documents</i>	focused on structured business messages, e.g. orders, invoices, payment orders etc. based on a standardized syntax and semantics
<i>among applications</i>	exchanged data will be automatically interpreted by applications.

Related terms ...

- EBDI: electronic business document interchange
 - Synonymous, more specific
- CALS: continuous acquisition and life cycle support, includes also technical data exchange
- electronic trading
 - Focuses on (a segment of) the business application
- electronic commerce – electronic business
 - focuses on the business application (trade, transport, administration)
- electronic markets or hierarchies
 - focuses on the governance structure or type of business relationship

Early EDI movers ...

- Airlines
- International banks
- Credit card organisations

➤ **What do they have in common?**

- international industry organisations (IATA) and communication networks (SWIFT, SITA),
- global businesses,
- high volume standardised transactions,
- information and communication as core business

Semiotic layers of EDI

Semiotic layer	Relevance for EDI
Syntax	message structure, e.g. type and sequence of fields in UN/EDIFACT
Semantics	contents of the fields, e.g. keys, identifiers etc.
Pragmatics	action - response patterns, e.g. business scenarios

Types of EDI message standards (syntax)

Varying scope of standardisation ...

		Sector-specific	Inter sectoral
Trade information	national	VDA (Automobile, D) TRADACOMS (Retail, UK)	ANSI X12 (USA)
	inter-national	ODETTE (Auto, Europe) EDIFACT Subsets	UN/EDIFACT
Product information	national	IGES, SET, VDAFS	
	inter-national	CAD-I	STEP
Document standards		ODA/ ODIF, SGML, DTAM	

Source: Neuburger 1994, 22

UN/EDIFACT

... standardised syntax rules for EDI messages designed by national and international *message development groups*

first published in 1987

E	lectronic
D	ata
I	nterchange
F	or
A	dministration (accounting, customs, pension, health care, social security, jurisprudence, job application, statistics)
C	ommerce (construction, finance, insurance, production and logistics, tourism, transaction) and
T	ransport (general transport, container movement, dangerous goods movement, forwarding)

UN/EDIFACT is ...

... a framework for a universal and global business language.

EDIFACT message examples

REQOTE	request for quote
QUOTES	quotation
PRICAT	price/sales catalogue
ORDERS	purchase order
ORDRSP	order response
DESADV	dispatch advice
INVOIC	invoice
PAYORD	payment order
DEBADV	debit advice
CREADV	credit advice

Konvertieren
EDIFACT nach XML
ORDERS

[EDI -> XML](#)

Anzeigen der Bestellung im Browser

[XML mit XSL](#)

Konvertieren
XML nach EDIFACT

[ORDRSP](#)

Beenden der Demo

[Ende](#)

EDI-Daten:

```
UNB+UNOC:3+433111111008:14+4121212120005:14+990519:1020+525  
+++++EANCOM'  
UNH+785+ORDERS:D:93A:UN:EAN007'  
BGM+220+014501234567'  
DTM+137:19990519:102'  
DTM+2:19990524:102'  
NAD+BY+4909090909991::9++Kunde AG Zentraleinkauf Abt.  
062+Richard-Wagner-Str. 2+Hamburg+40000++DE'
```

Info

Dieses Demo ist nur lauffähig mit dem
Internet Explorer 5.0 oder höher!

Dieses Demo wird Ihnen zur Verfügung gestellt
von

stratEDI!

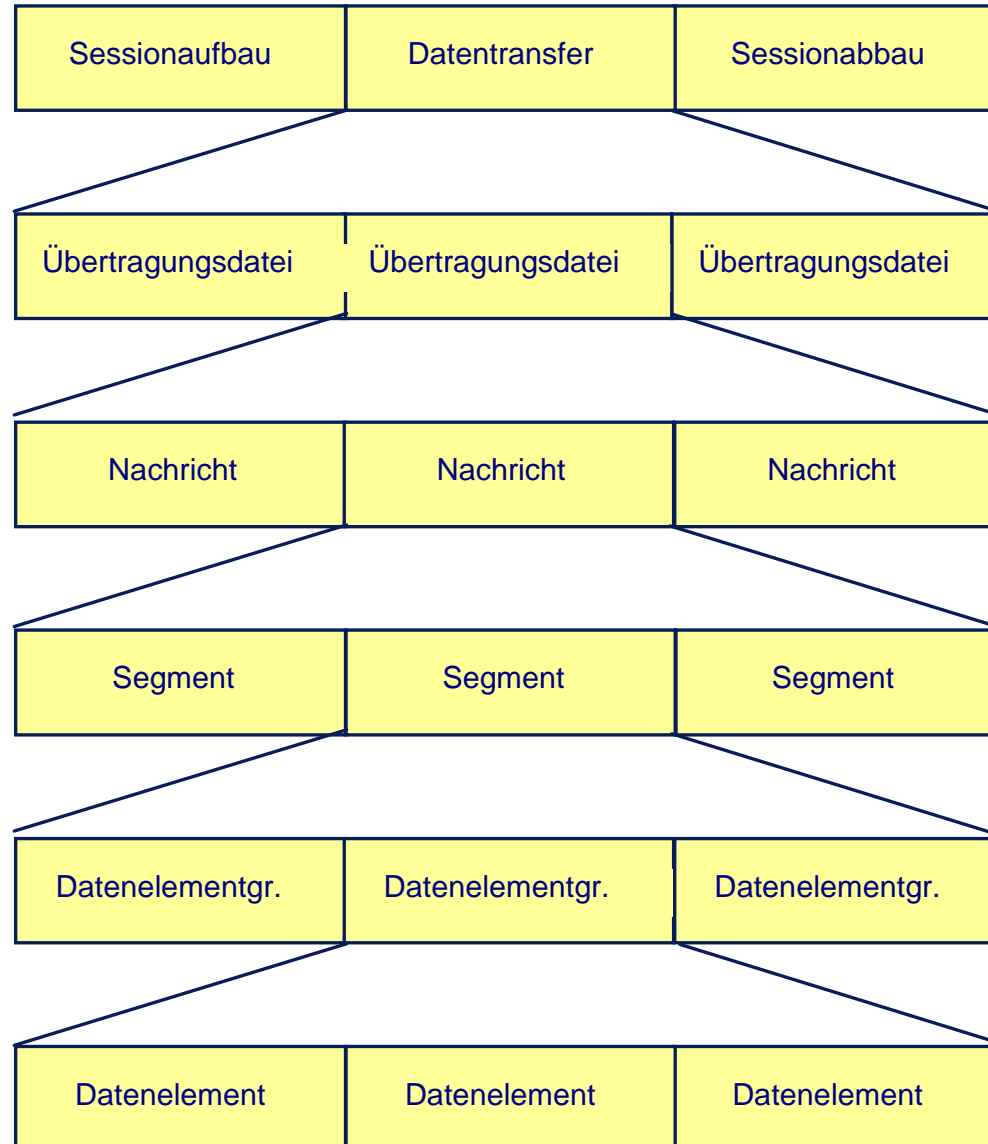
Copyright © 2002 [stratEDI GmbH](#)

XML-Daten:

```
<?xml version='1.0' ?>\n"  
<?xml-stylesheet href='ORDRSP.xsl' type='text/xsl'?>\n"  
<!-- (c) by stratEDI GmbH - http://www.stratedi.de -->\n"  
<Message>  
  <UNB SI='UNOC' SVN='3' ISQ='14' IRQ='14' DATE='990519'  
TIME='1020' ICR='525' CAI='EANCOM'>  
    <IS>49999999123123</IS>  
    <IR>43344000000008</IR>  
  </UNB>  
<Bestellung>  
  <UNH MTI='ORDRSP' MTVN='D' MTRN='93A' CA='UN'  
AAC='EAN004'>  
    <MRN>785</MRN>  
  </UNH>  
<BGM ID='231' MFC='29'>
```

Info

EDIFACT message structure



EDIFACT Data element

“BuyerOrderContactPhoneNo” in ORDERS:

- Segment COM in segment group 5 has a composite data element C076 containing two data elements, 3148 carrying a number of some sort and 3155 qualifying that number. If the value carried in 3155 is TE, then the number carried in 3148 is a telephone number. Element 3155 has 40 other possibilities of number that 3148 might carry.
- To determine the kind of telephone number, it is necessary to know to check element 3139 in segment CTA. There are 79 possibilities. If 3139 carries a value of OC, then it is a contact for the Purchase Order.
- To determine which order contact, check element 3035 in the NAD segment in segment group 2. Here there are 270 possibilities. If element 3035 carries the value BY, it is a contact telephone number of the buyer for queries about the purchase order.

EDI messages: different standards

Process	VDA	Odette	EDIFACT	ANSI X12
Inquiry, request for quotes	4909	ENQIRY	QUOTES	840
Offer	4910	OFFERR	QUOTES	843
Order	4925	ORDERR	ORDERS	850
Order response	-	REPORD	ORDRSP	855
Order change	4925	ORDCHG	ORDCHG	860
CAD/CAM data	4951	ENGDAT	CONDRA	841
JIT delivery	4915	CALOFF/CALDEL	DELJIT	862
Credit advise	4908	SEBINV	CREADV	?
KANBAN	-	KANBAN	DELJIT	862
Inventory report	4913 VA 35	STOACT	INVRPT	?
Delivery instruction	4905	DELINS	DELFOR	830
Dispatch advise	4913	AVIEXP	DESADV	856
pickup-sheets	-	CALDEL/CALOFF	DELJIT	862
Price list/ catalog	4911	PRILST	PRICAT	832
Invoice	4906	INVOIC	INVOIC	810
Remission advice	4907	REMADV	REMADV	820

Source: Ströcker 1998

EDIFACT design principles

Standardisation of the message syntax, i.e.

- distinction between **syntax** and **semantics**
product identification (e.g. EAN) and company identification (X.500) are not part of EDIFACT
- distinction between **message** and **communication**
(e.g. TCP/IP, SMTP, X.400, FTAM)

EDI semantics: examples

Integration
Pragmatics
Semantics
Syntax

- **Article numbers**
 - European Article Number (EAN) provides a framework for product classification and bar coding
 - Universal Product Code (UPC in the U.S.)
- **International Standard Book Number (ISBN)**



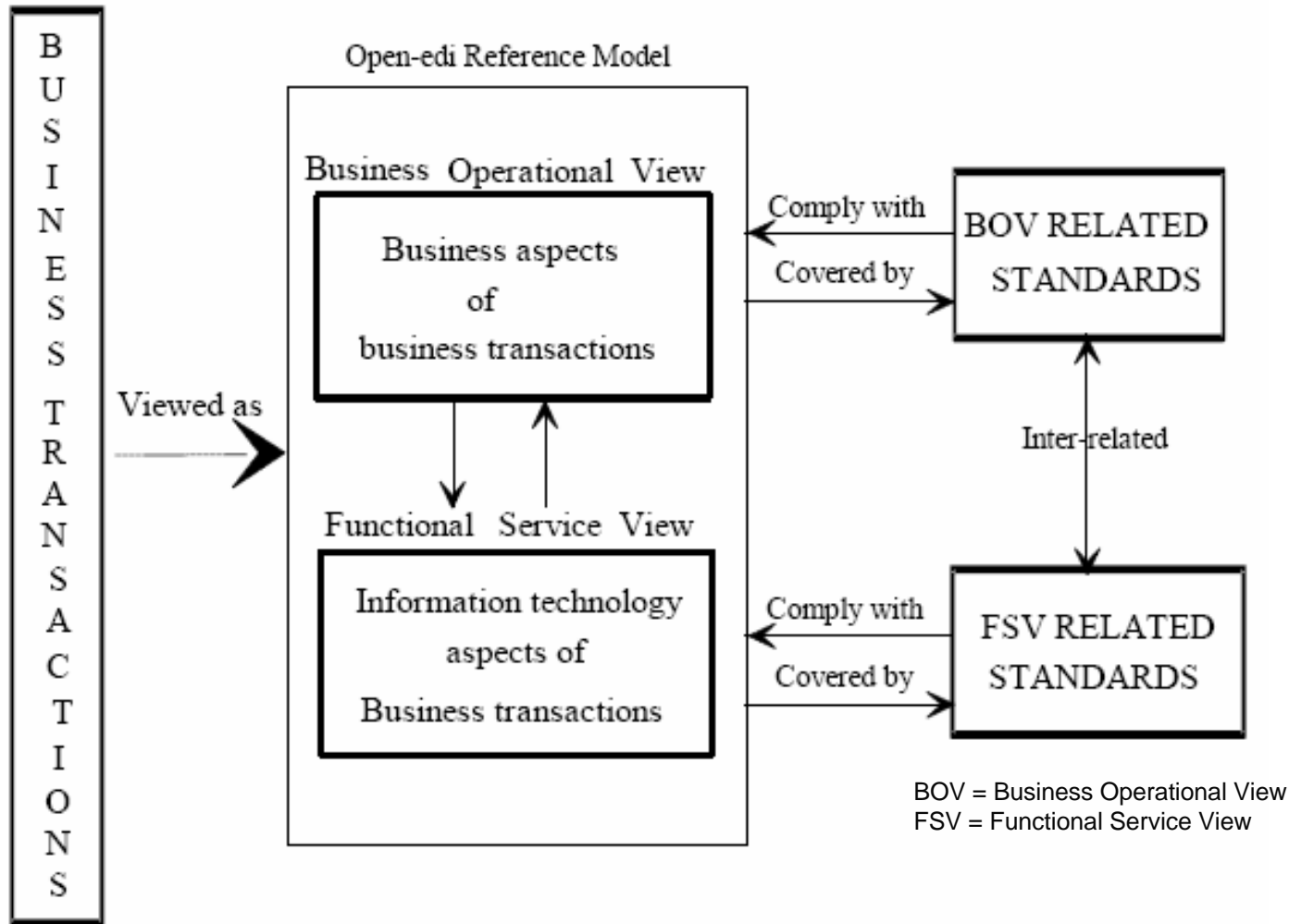
EAN/UCC-13 bar code
and ISBN number on
the back cover of a book

- **International Standard Series Number (ISSN)**
- **X.500 (company directory)**

EDI pragmatics: elements, examples

- interchange agreements
 - contractual arrangements for EDI
 - business scenarios
 - action - response patterns, e.g. response time for orders, lead time for delivery notes etc.
- Open-EDI is an ISO activity to develop standardised business scenarios in order to facilitate EDI beyond the realm of established business relations.
- “The application to application exchange of any predefined and structured data for business purposes without human intervention and without prior agreement”

Open-EDI reference model

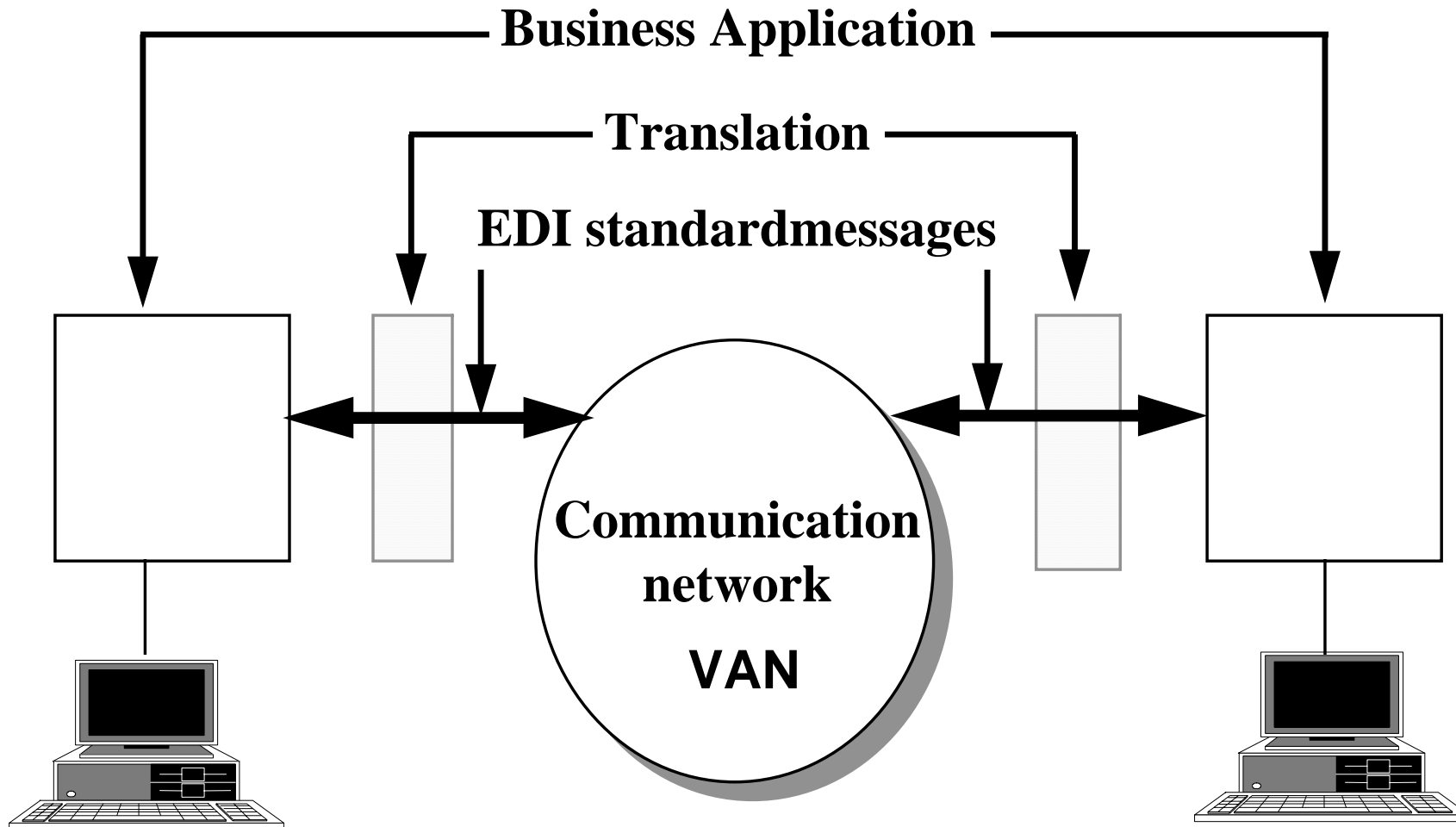


EDI layer model

Firm 1	↔ Contract ↔ Interchange agreement	Firm 2
Integration	EDI enabled applications	Integration
Pragmatics	Open EDI, CPFR, SCOR	Pragmatics
Semantics	e.g. ISBN, ISSN, EAN/UCC-13	Semantics
Syntax	UN/EDIFACT, ANSI X12, XML	Syntax
Data transfer	TCP/IP	Data transfer
Security etc.	RSA	Security etc.

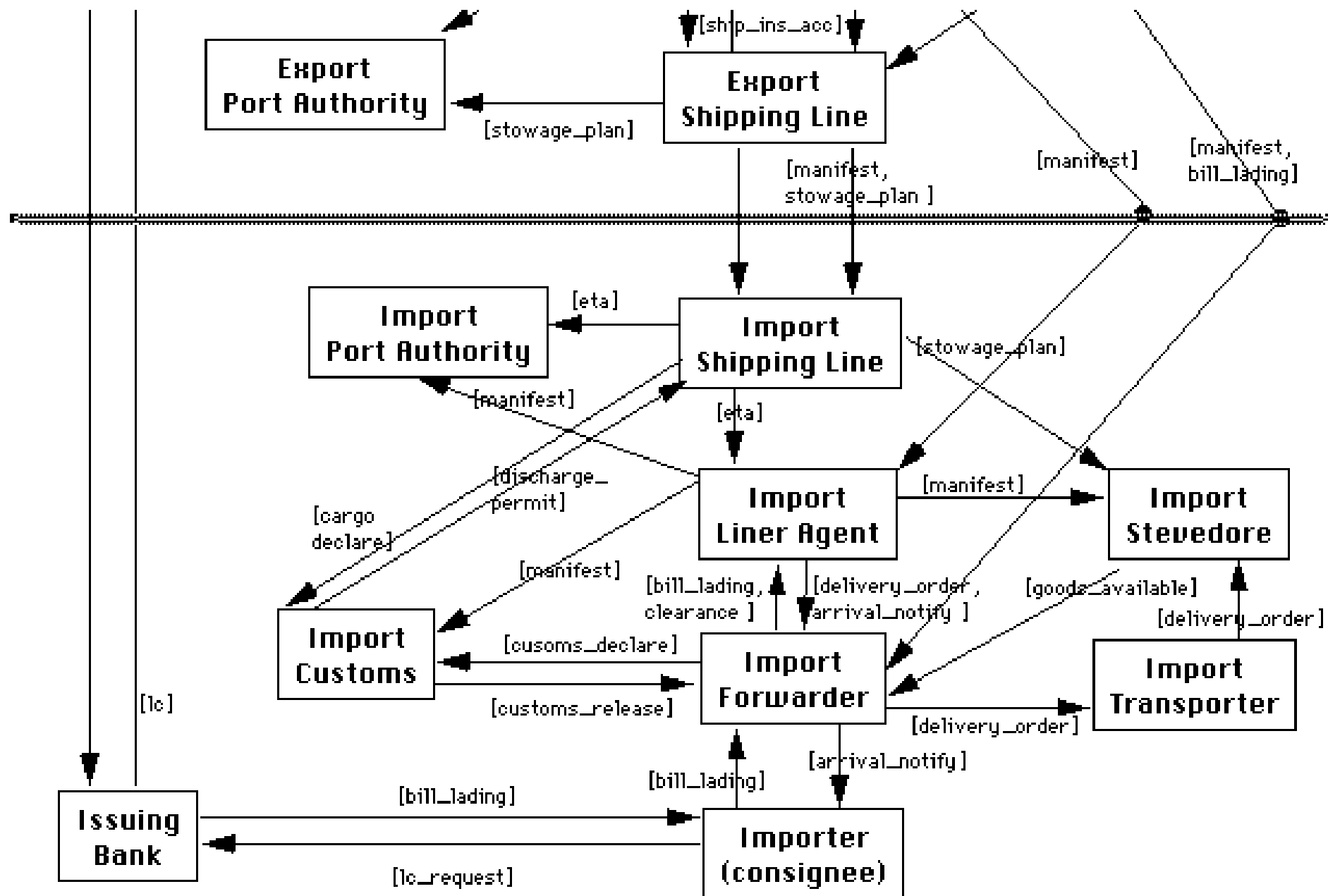
Adapted from Kubicek

EDI message exchange

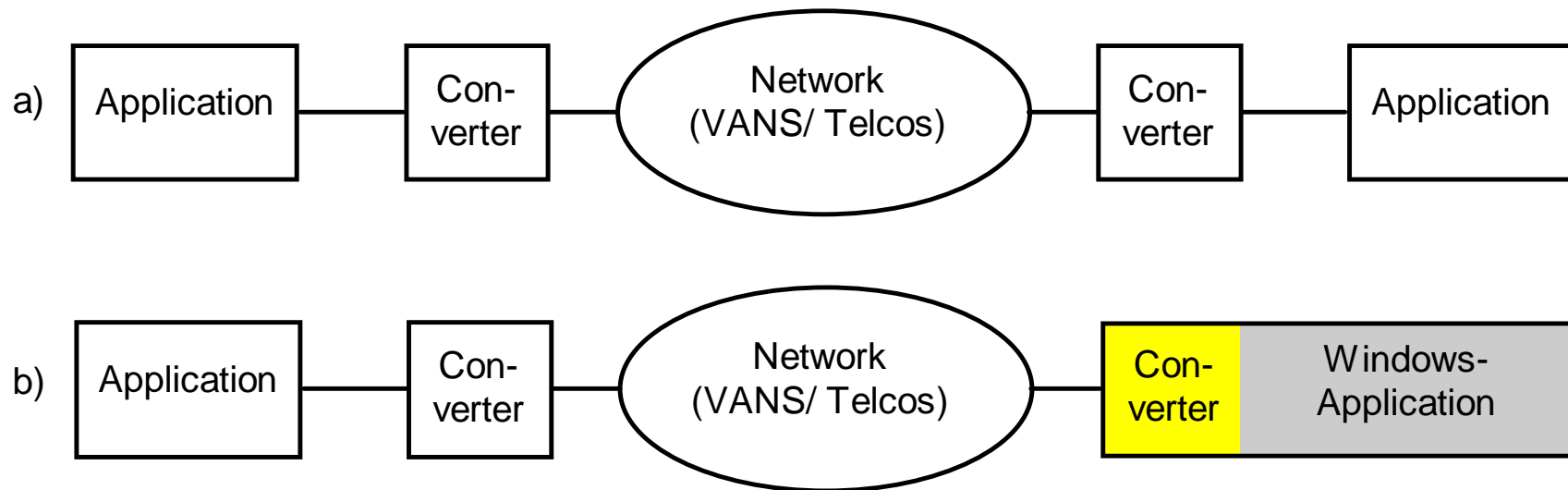


Loose coupling

- EDI based on EDIFACT attempts a universal exchange of standardised messages
- without making specific requirements on the side of the participants' IT (i.e. relationship specific investments, asset specificity) other than
- being able to generate, send and receive EDI messages.
- Therefore the minimum requirement is typically the implementation of an EDI converter and communication facilities.



EDI: VANS based architectures



Development trends

- Semantics
- Scenarios and Architectures

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Message standards

- XML-based standardisation activities
 - semantics
 - syntax
 - pragmatics

XML semantics: examples

Integration
Pragmatics
Semantics
Syntax

- **cXML (Commerce XML)**
 - Ariba Inc. + strong industry group (www.cxml.org)
- **xCBL (XML Common Business Library)**
 - CommerceONE Inc. (www.xcbl.org)
 - exchange of data and development of e-business applications (esp. procurement scenarios)
- **BMEcat**
 - Bundesverband Materialwirtschaft, Einkauf und Logistik e.V. (www.bmecat.org)
 - standardising the exchange of product data catalogs between suppliers and purchasing organisations
 - developed by the ‘eBusiness Standardization Committee’

XML semantics: Commerce XML (cXML)

cXML is

- a **proprietary specification** copyrighted by Ariba Inc., first published in 1999, however, more than 40 companies have contributed to the specification looking to reduce the costs of B2B electronic commerce,
- a **set of document type definitions** (DTD) for the XML specification,
- a **meta language** that defines necessary information about a product,
- used to standardise the **exchange of catalog content** and to define request/response processes for secure electronic transactions over the Internet,
- addressing **processes** such as purchase orders, change orders, acknowledgments, status updates, ship notifications and payment transactions.

XML semantics: XML Common Business Library (xCBL)

- xCBL 4.0 was published in March 2003
- Result of collaboration between Commerce One and XML standards bodies, e-commerce enterprises, and hardware and software vendors, as well as analysis of existing e-commerce standards including Electronic Data Interchange (EDI), RosettaNet, and Open Buying on the Internet (OBI)
- Set of XML building blocks and a document framework that allows the [creation of XML documents for e-commerce](#)
- Available in various formats: as a set of SOX schemas, as W3C XSDL schemas, in XML DTD form, and as a set of XDR schemas
- [Support documents and transactions for global e-commerce](#) including multi-company supply chain automation, direct and indirect procurement, planning, auctions, and invoicing and payment in an international multi-currency environment.

XML semantics: BMEcat

- BMEcat was published the first time at the end of 1999
- eBusiness Standardisation Committee and Bundesverband Materialwirtschaft, Einkauf und Logistik e. V. (BME) published the XML-based catalogue exchange format in cooperation with the Fraunhofer IAO and the University of Essen
- Most widespread exchange standard for **electronic product catalogs** in German-speaking countries
- Structured **representation of (multi-media) product data**, e.g. basic data, packaging data, price data, multi-media additional data, article structure data, catalogue structure data

XML syntax: example

Integration

Pragmatics

Semantics

Syntax

```
<?xml version=„1.0“ encoding=„UTF-8“?>
<!DOCTYPE BMECAT SYSTEM „bmecat_new_catalog.dtd“>
<BMECAT version=„1.2“>
...
<SUPPLIER>
  <SUPPLIER_NAME>HatAlles GmbH</SUPPLIER_NAME>
  <ADRESS type=„supplier“>
    <NAME>HatAlles GmbH</NAME>
    <STREET>Hintern Dorf 7</STREET>
    <CITY>Kleinstadt</CITY>
    <ZIP>54321</ZIP>
    <COUNTRY>DE</COUNTRY>
  </ADRESS>
</SUPPLIER>
...
</BMECAT>
```

XML pragmatics

Integration
Pragmatics
Semantics
Syntax

- **OBI (Open Buying on the Internet)**
 - Initiative to encourage electronic business
- **CPFR (Collaborative Planning, Forecasting and Replenishment)**
 - Voluntary Inter-industry Commerce Standards (VICS) Association
 - Realisation of efficient procurement processes
- **RosettaNet**
 - Simplification and rationalisation of supply chain management
- **ebXML**
 - Encouragement of inter-organisational business processes for SMEs

XML pragmatics: OBI

- **Open Buying on the Internet (OBI)** Consortium is an independent, non-profit organisation dedicated to developing open standards for B2B Internet commerce managed by CommerceNet
- OBI architecture was published the first time in 1997
- Driving the adoption of **purchasing on the Internet**; aiming at high-volume, low-cost-per-item transactions
- Streamlining the non-mission critical procurement processes of organisations (e.g. MRO materials) by specifying a standard set of roles that OBI-compliant selling and buying parties must conform to
- Interaction of **four entities**: requisitioner, buying organisation, selling organisation, payment authority
- Already addressed steps in the purchasing process: order request, purchase order, purchase order acknowledgement, advance ship notification, order status
- In development: invoice and payment transaction types

XML pragmatics: CPFR

- Collaborative Planning, Forecasting and Replenishment (CPFR) is defined in a set of guidelines supported by The Voluntary Interindustry Commerce Standards (VICS) Association and published in 1998
- Mission: improve the partnership between retailers and vendor merchants through **shared information**
- CPFR is a set of business processes that entities in a supply chain can use for collaboration in a number of buyer/seller functions, towards overall efficiency in the supply chain
- Steps of **CPFR process**: front-end agreement, joint business plan, sales forecast collaboration, order forecast collaboration, order generation/delivery execution

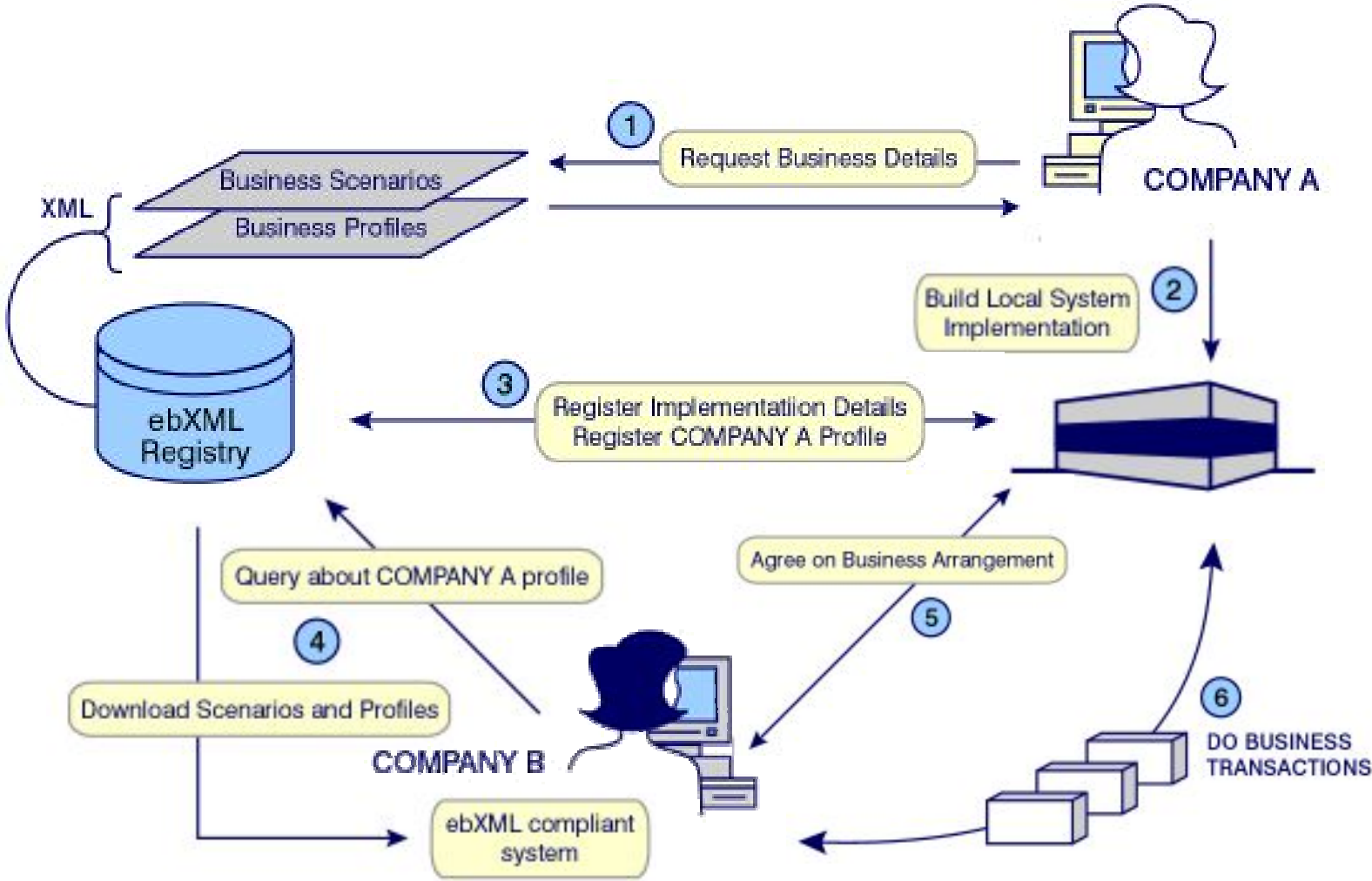
XML pragmatics: RosettaNet

- **Consortium** of more than 400 Electronic Components (EC), Information Technology (IT), Semiconductor Manufacturing (SM) and Solution Provider (SP) companies founded in June 1998
- Creating, implementing and promoting open e-business standards that form a **common e-business language**, aligning processes between trading partners on a global basis
- RosettaNet standards encompassing data dictionaries, implementation framework, and XML-based business message schemas and process specifications
- RosettaNet Implementation Framework: exchange protocols for quick and efficient implementation of RosettaNet standards
- RosettaNet Partner Interface Processes: system-to-system XML-based dialogs that define business processes between trading partners, applying to the following core processes: Administration; Partner, Product and Service Review; Product Introduction; Order Management; Inventory Management; Marketing Information Management; Service and Support; and Manufacturing

XML pragmatics: ebXML

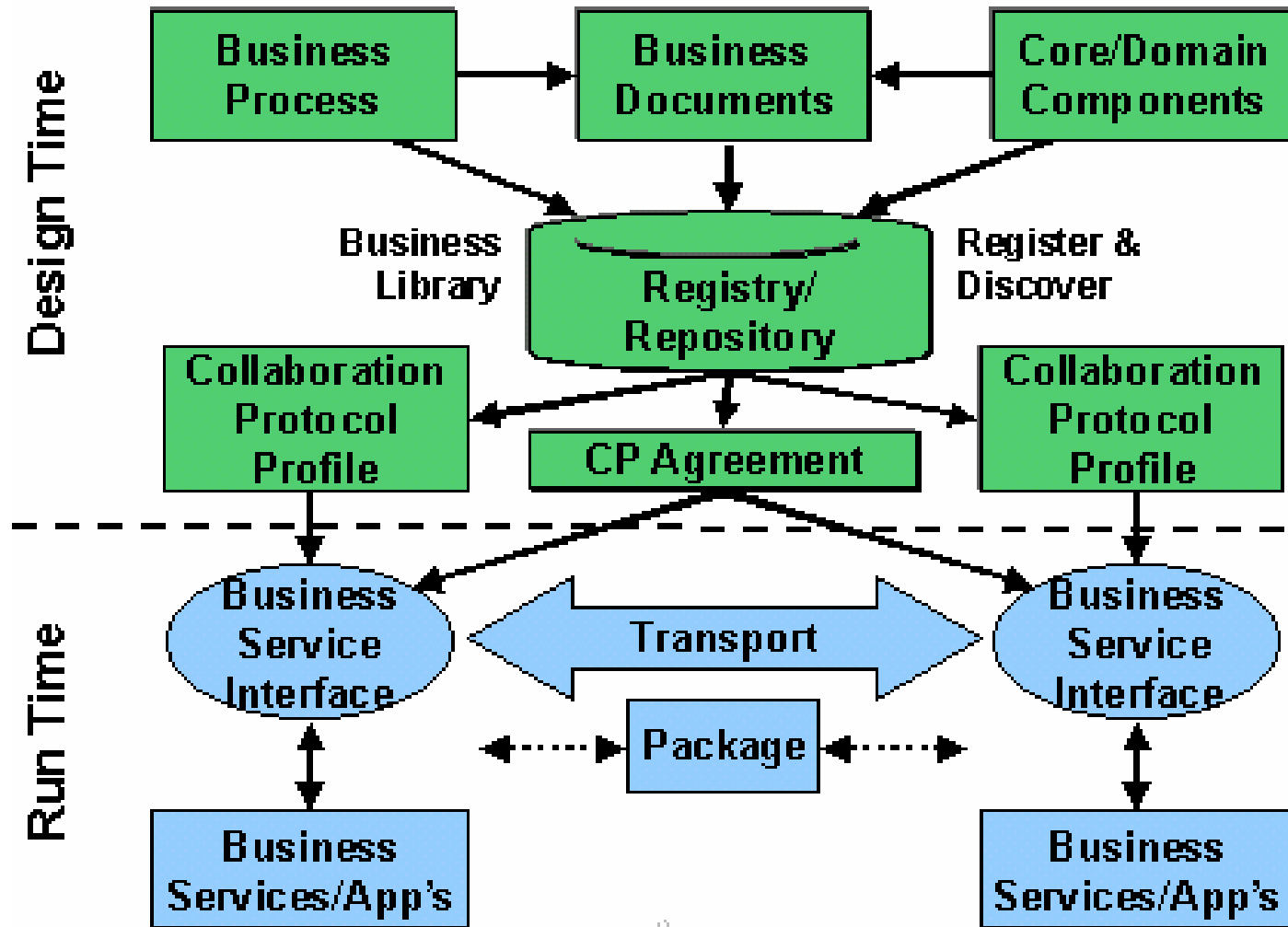
- ebXML sponsored by UN/CEFACT and OASIS, is a modular suite of specifications that enables enterprises of any size and in any geographical location to conduct business over the Internet
- ebXML framework will become an international standard, most likely under the auspices of UN/CEFACT
- Supporting messages and services among businesses as well as between businesses and consumers
- Offering businesses of all sizes a common message structure and syntax for exchanging business data over data networks like the Internet using XML
- ISO approves OASIS e-business standards in March 2004
- <http://www.ebxml.org/>

High-level overview of ebXML interaction between two companies



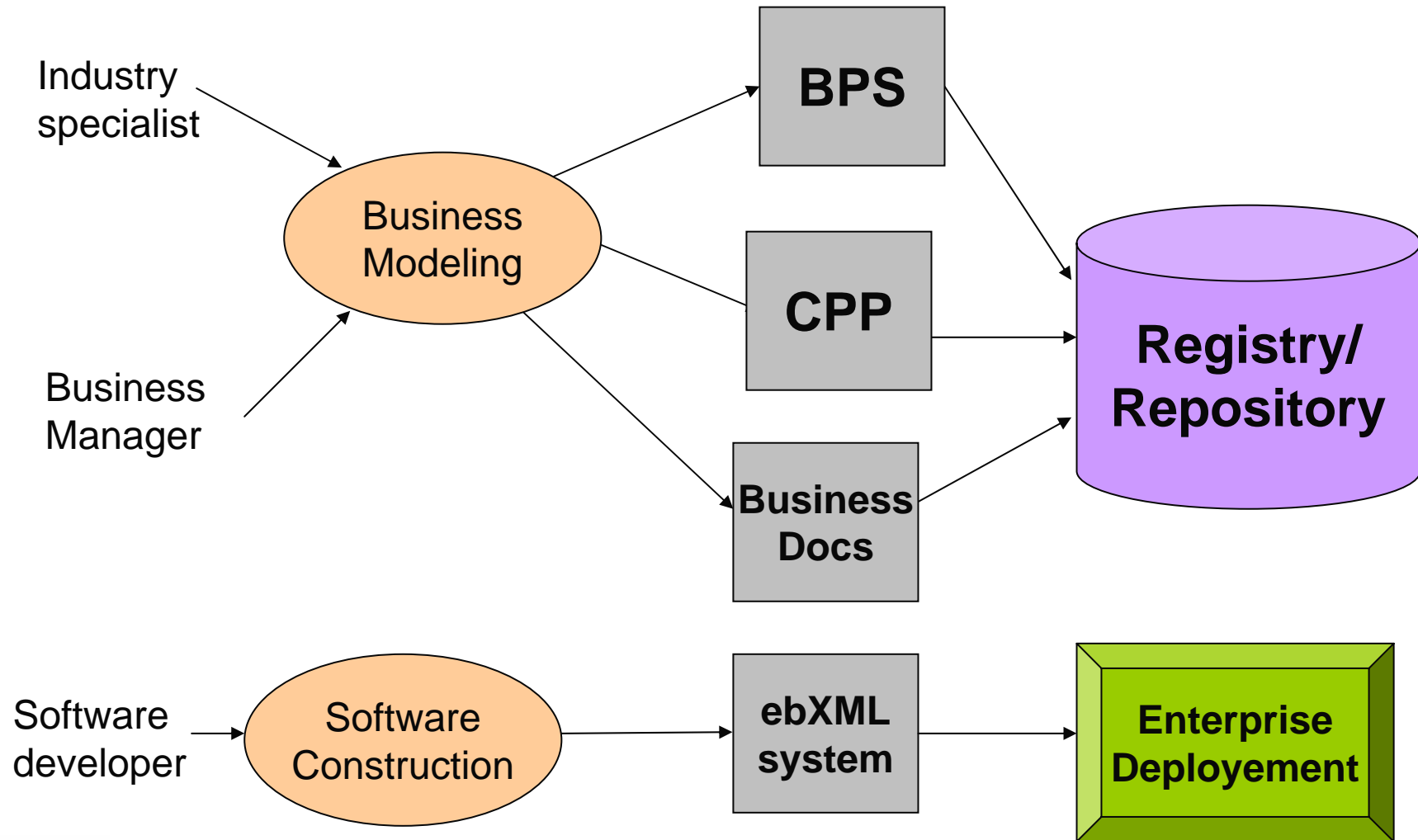
Source: ebxml.org

An Overview of Functional Components in ebXML



Source: ebxml.org

ebXML Design



Source: ebxml.org

ebXML Registry/Repository

- A Registry Item identifies and describes its associated information,
 - gives its administrative and access status,
 - identifies the submitting and responsible organizations, and
 - classifies them according to pre-defined classification schemes
- In ebXML, for each item in the registry, there is a universally unique identifier
- Note that queries are sent as messages to the registry which provides implementation independent execution of a query

The Collaboration Protocol Profile (CPP)

- The Collaboration Protocol Profile (CPP) provides the definition (DTD and W3C XML Schema) of an XML document that specifies the details of how an organization is able to conduct business electronically
- The Collaboration Protocol Profile (CPP) is an XML document that specifies:
 - Contact information (business address, industry classification, etc.)
 - Supported business processes
 - Transport protocol
 - Security mechanisms

Summary of ebXML terms

- **BPSS**
 - Business Process Schema Specification – Meta model in XML (A Choreographed set of business transactions between partners)
 - UMM
 - UN/CEFACT Methodology & UML profile for EDI specification
- **Core Components**
 - Common data structures for message interchange in a context
- **CPP**
 - Collaboration Partner Profile – Lists partner processes & technologies
- **CPA**
 - Collaboration Protocol Agreement – Runtime partner binding
- **Reg-Rep**
 - Registry & Repository – Storage for metadata and partners
- **TRP**
 - Transport Routing & Packaging – Wire protocol

XML integration: OAGIS

Integration
Pragmatics
Semantics
Syntax

- The Open Applications Group (OAG), formed in February 1995 by the leading worldwide enterprise software vendors, is a non-profit consortium focusing on best practices and process based XML content for eBusiness and Application Integration
- First release of OAGIS (Open Applications Group Integration Specification) in February 1996
- Release 8.0 of OAGIS released in March 2003
- Integration of intra- and inter-organisational applications
- Key deliverables: architecture, business collaboration definitions, XML message definitions, data dictionary, UML definitions
- <http://www.openapplications.org>

	<i>Inhalte spezifiziert durch</i>	<i>Organisatori- sche Aspekte berücksichtigt</i>	<i>Zustand der Dokumentation</i>	<i>Wiederverwendung</i>	<i>pro- prie- tär</i>	<i>bereits im Einsatz</i>
CXML www.cXML.org	XML-DTDs	nein	umfangreich, aber lückenhaft und teilweise oberflächlich	ggfs. von einschlägigen Parsern und Konvertierern; zudem Software von Ariba	ja	eingeschränkt: Schnittstellen wer- den von Ariba-Soft- ware unterstützt
XCBL www.commerce One.com/xml	SOX Schemata	nein	großer Umfang, sehr detailliert	ggfs. von einschlägigen Parsern und Konvertierern; zudem Software von CommerceOne	ja	eingeschränkt: Schnittstellen wer- den von Commerce- One-Software unterstützt
BMecat www.bmecat.org	XML-DTDs	nein	geringer Umfang, gut nachvollziehbar	ggfs. von einschlägigen Parsern und Konvertierern	nein	bei einigen Unternehmen in der Erprobung
OBI www.openbuy.org	ANSI X12 EDI	ja	umfangreich und detailliert	„Architecture“, Vorgehens- weise; ggfs. einschlägige Werkzeuge	nein	nein
CPFR www.cpfr.org	ANSI X12 EDI	ja	Vision überzeu- gend vermittelt; ansonsten oberflächlich und lückenhaft	„Business Model“, Vorgehens- weise, ggfs. einschlägige Werkzeuge	nein	nein
RosettaNet www.rosettanet.org	XML-DTDs (geplant)	ja	umfangreich, detailliert, sachkundig	„Business Modell“, Vorgehens- weise; ggfs. einschlägige Werkzeuge	nein	nein
EbXML www.ebxml.org	XML-DTDs	ja	rudimentärer Zustand	beabsichtigt: Geschäfts- modelle, Vorgehensweisen vor allem für KMU	nein	bisher lediglich ein wenig detailliertes Anwendungs- szenario
OAGIS www.openapplications. org	XML-DTDs	nein	umfangreich und detailliert, aber z. Z. kaum hinreichend	ggfs. eine Vielzahl zertifizierter Anwendungs- komponenten	nein	nein

Conclusions

- Numerous ongoing standardisation activities
- Wide scope in terms of
 - Focus (industry, semantics, syntax, pragmatics)
 - Participation
 - Openness
- Some of the standardisation activities address syntax, semantics and pragmatics

Agenda

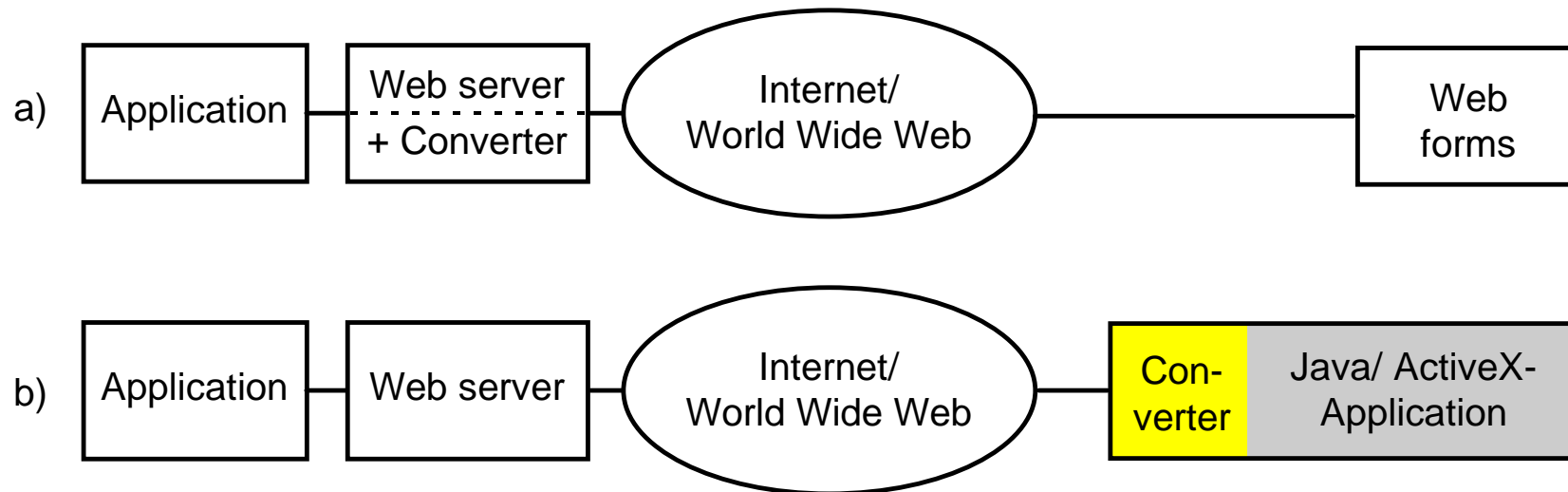
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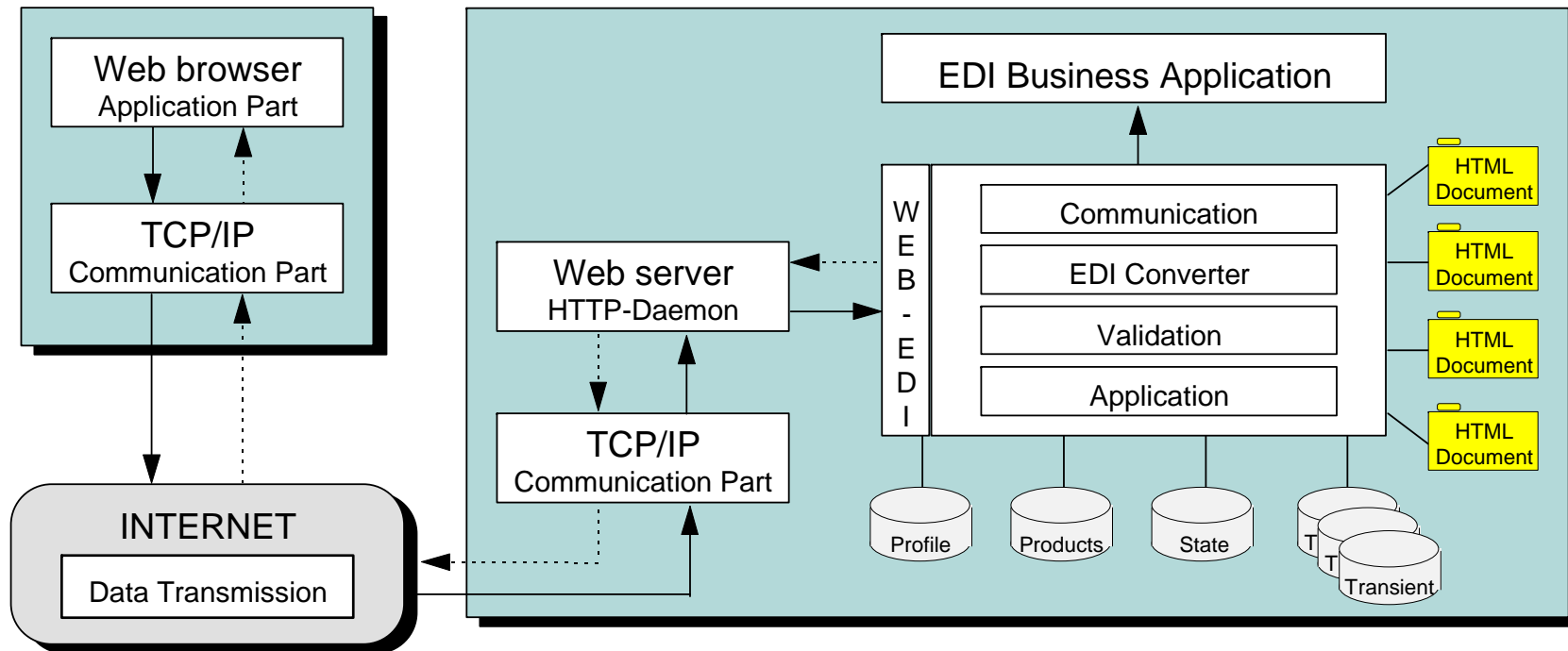
B. Enterprise Application Integration (EAI)

C. Middleware

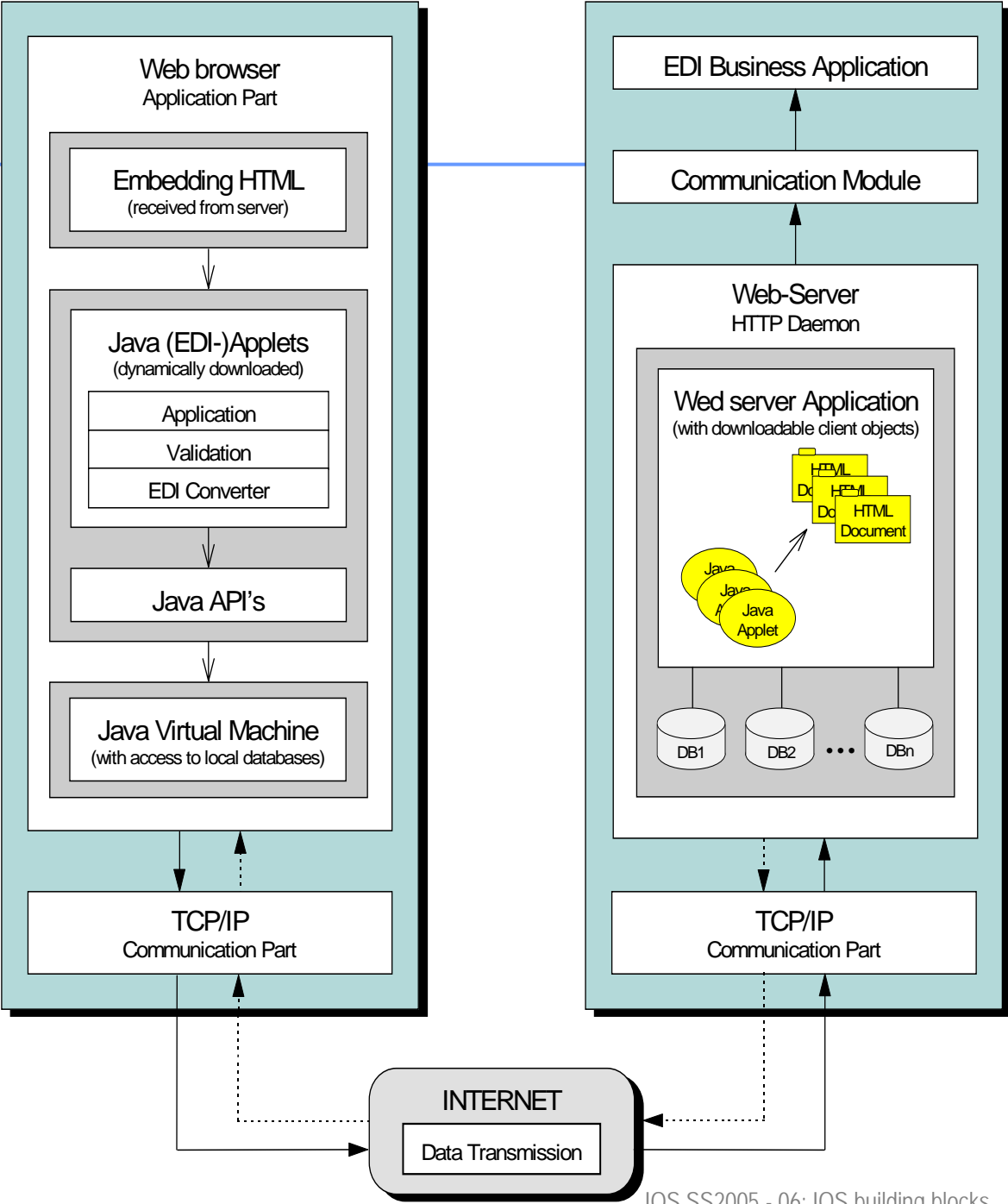
EDI: Web based architectures



Forms-based Web/ EDI Application Structure



Applications with Java-based Web clients



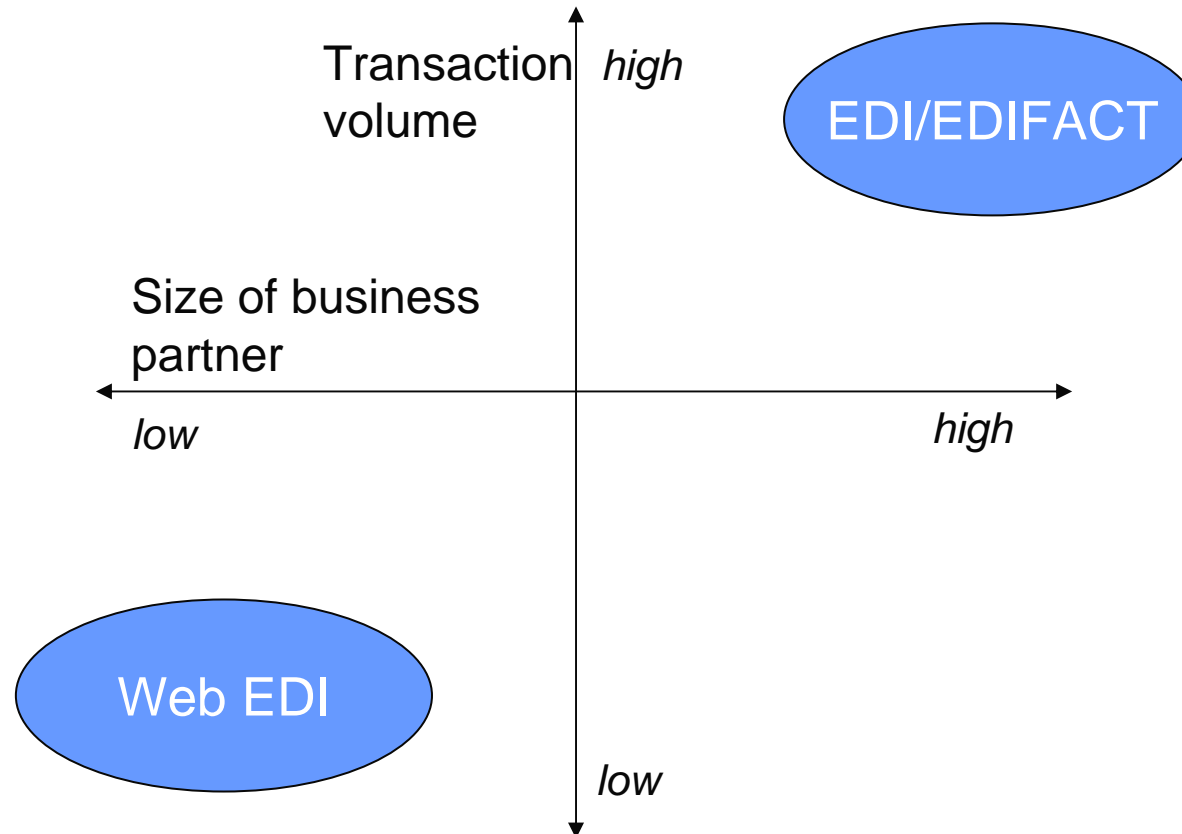
"The death of EDI?"

- The Internet lowers entry barriers for EDI
- The Web enables the integration of EDI into a multiplicity of services
- Differentiation of interfaces on the adoptor side

Extending the EDI scenario ...

- the communication scenario includes human-to-application links as well as application-to-application,
- EDI becomes an integral part of a much broader set of electronic commerce applications which cover areas like marketing and customer support,
- internal integration and automation are maintained wherever possible and functional.

Differentiated EDI scenarios



Forecast:

Accelerated diffusion and adoption of EDI

- telecommunication infrastructures and services become widely available, the costs are likely to go down;
- public, commercial and political awareness is high and EDI initiatives are abundant;
- electronic commerce applications in retail and business-to-business are mushrooming and
- EDI communities are emerging and expanding in many industries.
- However, instead of a few international efforts like UN/EDIFACT or ANSI X12 we see numerous smaller and more focused initiatives.

References

- Frank, U.: Standardisierungsvorhaben zur Unterstützung des elektronischen Handels,
in: Wirtschaftsinformatik 43 (2001) 3, pp. 283-293.