1.264 Lecture 24
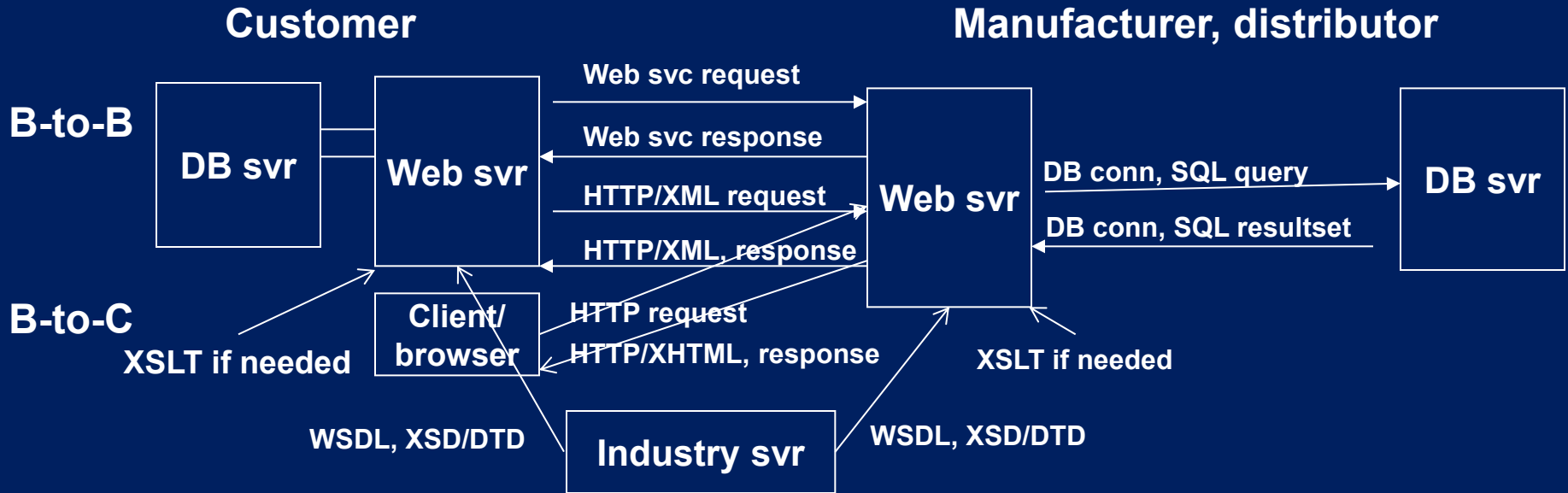
Service Oriented Architecture
Electronic Data Interchange (EDI)

Next class: Anderson chapter 1, 2. Exercise due <u>before</u> class

Solution- case study

Customer **Manufacturer, distributor**

B-to-B

DB svr — Web svr

Web svc request →
Web svc response ←
HTTP/XML request →
HTTP/XML, response ←

Web svr

DB conn, SQL query →
DB conn, SQL resultset ←

DB svr

B-to-C

XSLT if needed →

Client/ browser

HTTP request →
HTTP/XHTML, response ←

XSLT if needed

WSDL, XSD/DTD

Industry svr

WSDL, XSD/DTD

- **XSLT used by customer or manufacturer/distributor to alter XML being sent or received**
- **XSD and/or DTD used by customer or manufacturer/ distributor to validate XML being sent or rec'd**
- **Web services package the HTTP, XML, XSD, request/response and URL used in "raw" XML transfers**
- **Web services described in WSDL documents in registry. E.g.,**
  - **Manufacturer/distributor registers Web service in UDDI registry**
  - **Customer discovers Web service and invokes it on mfr/distrib Web server**
- **Visual tool: CSS for XHTML, XSLT for XML**

Challenges of system integration

- **Companies use multiple systems that must increasingly cooperate**
    - **Systems often are in different business groups**
    - **Or in different companies (vendors, channel partners…)**
    - **Run on different platforms (operating system, hardware)**
    - **Written in different languages**
    - **Use different communication protocols**
        - **File transfer, EDI, XML, RPC, MQ, CORBA, COM, sockets…**
    - **Have different databases, data definitions**
    - **Have different objectives, run at different times/periods**
- **Solution is desired that allows integration in spite of different languages, protocols, hardware…**

Service oriented architecture (SOA)

- **Web services are basis for integration in SOA**
- **A core of standard open technologies are used**
  - **XML, XML Schema (XSD), XSLT, SOAP, WSDL**
  - **Operating system-, hardware-, software-, database-neutral**
- **A registry (database) is used to store WSDL for service discovery**
- **Security, reliability, performance, transactions must be added to 'primitive' Web services to have SOA**
- **SOA supports composition (assembling) of services, reusability of services, extensibility**
- **SOA is based on a service-focused business model**
  - **UML business process models can be implemented in SOA**

Service oriented architecture 2

- **SOA is based on loose coupling between systems**

- **Asynchronous, or message-oriented (MOM) integration**
  - **Document is sent from system A to system B**
  - **Response generally not guaranteed in any given time**
    - **A process may not complete for a long time**
    - **Example: Shipment tracking service (success)**
    - **Example: Async telecom service orders system (failed)**
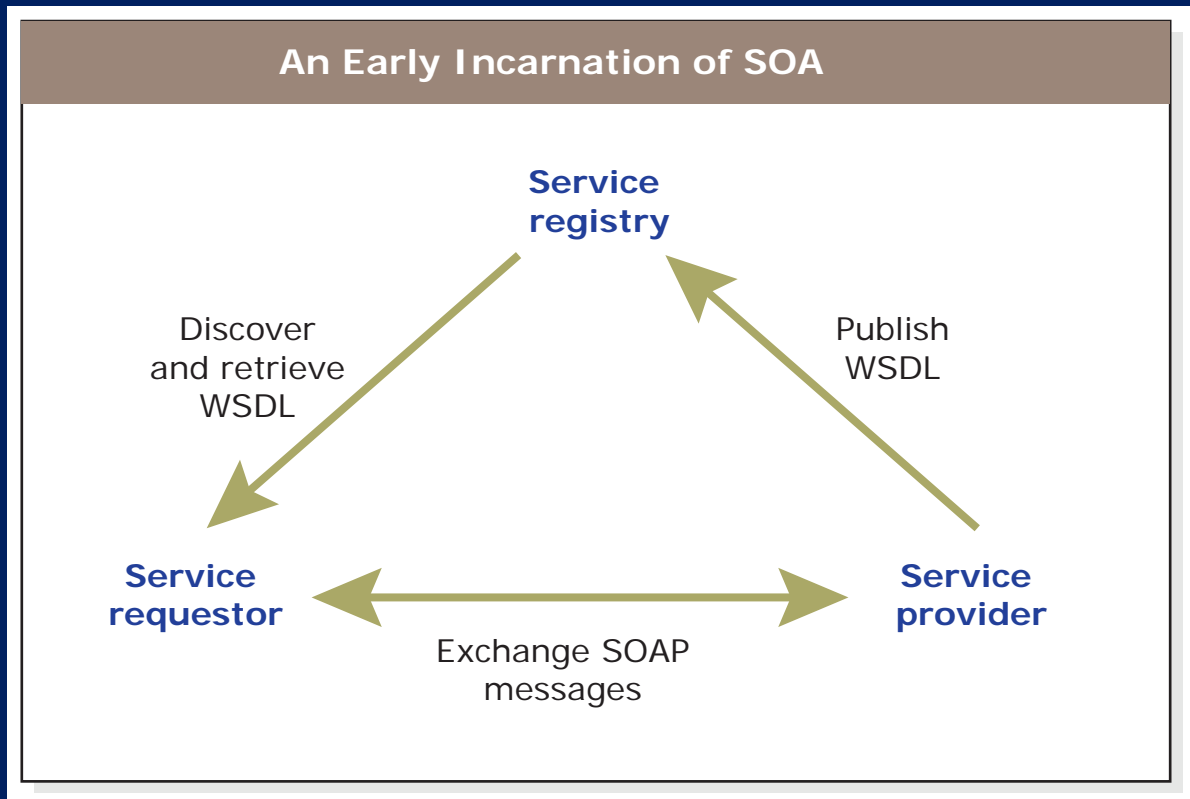
Example of current SOA implementation

An Early Incarnation of SOA

Service registry

Discover and retrieve WSDL

Publish WSDL

Service requestor — Exchange SOAP messages — Service provider

Image by MIT OpenCourseWare.

Service is Web service

SOA architecture (between Web servers)
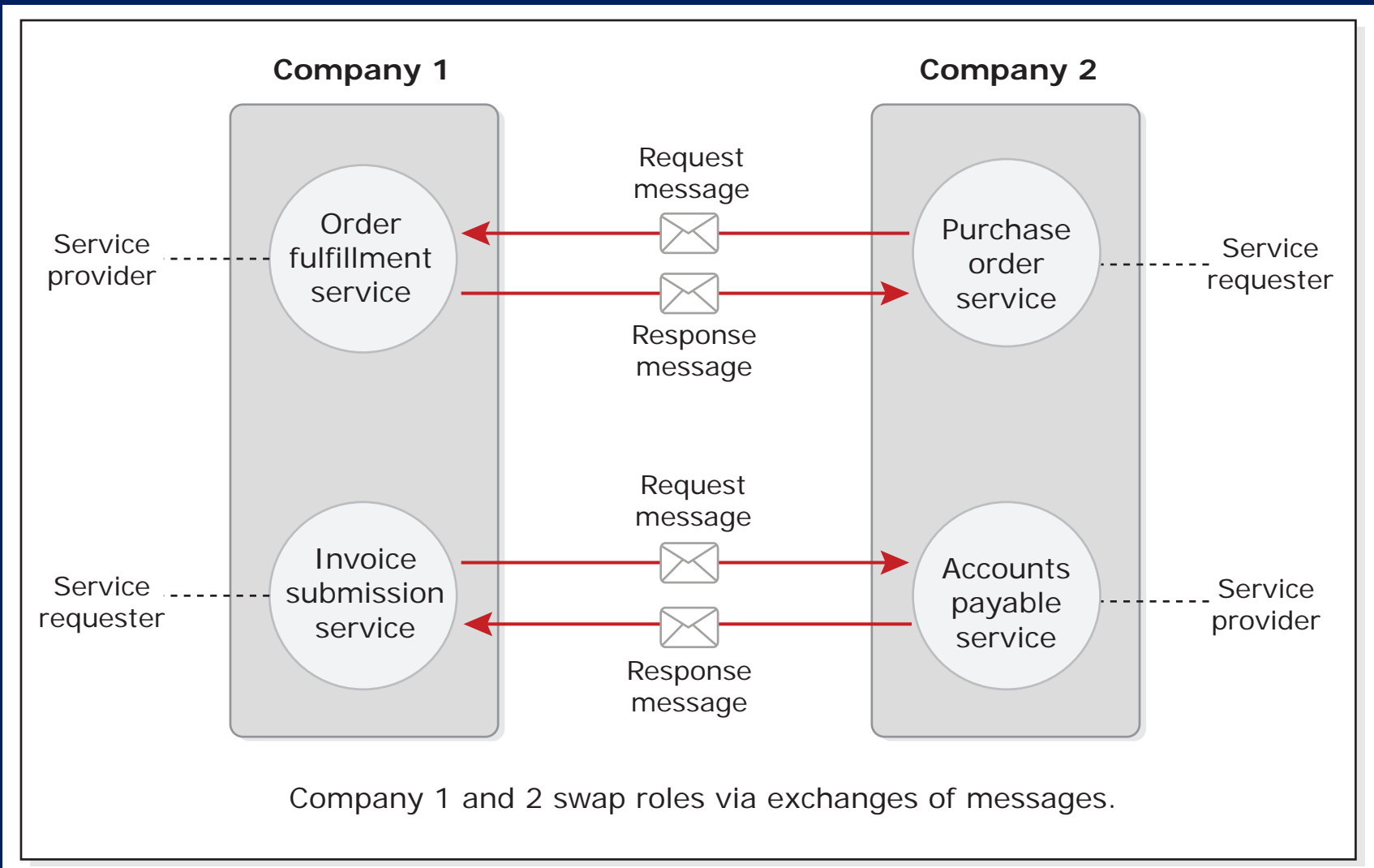

Company 1 and 2 swap roles via exchanges of messages.

SOA use of WSDL
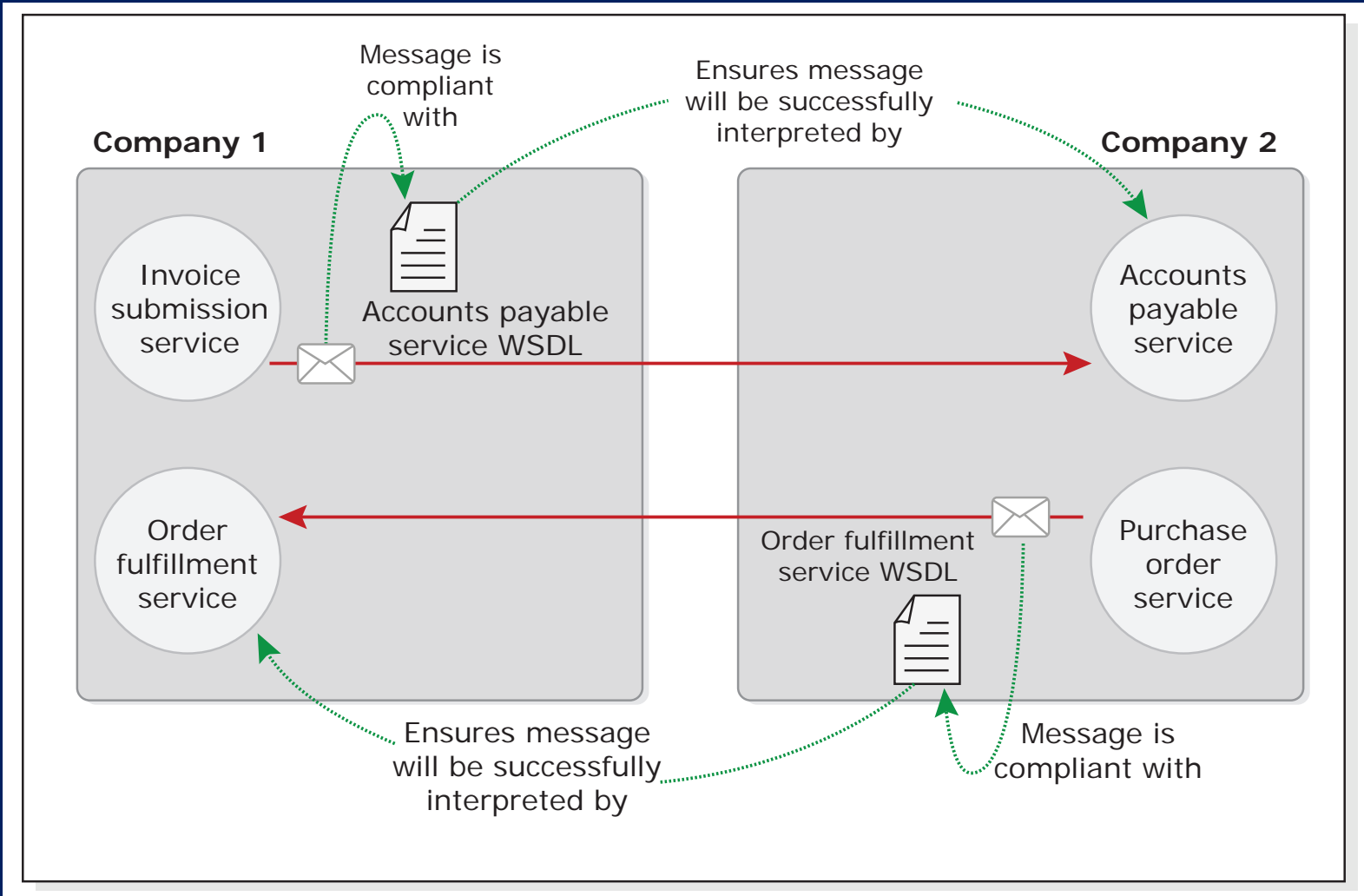
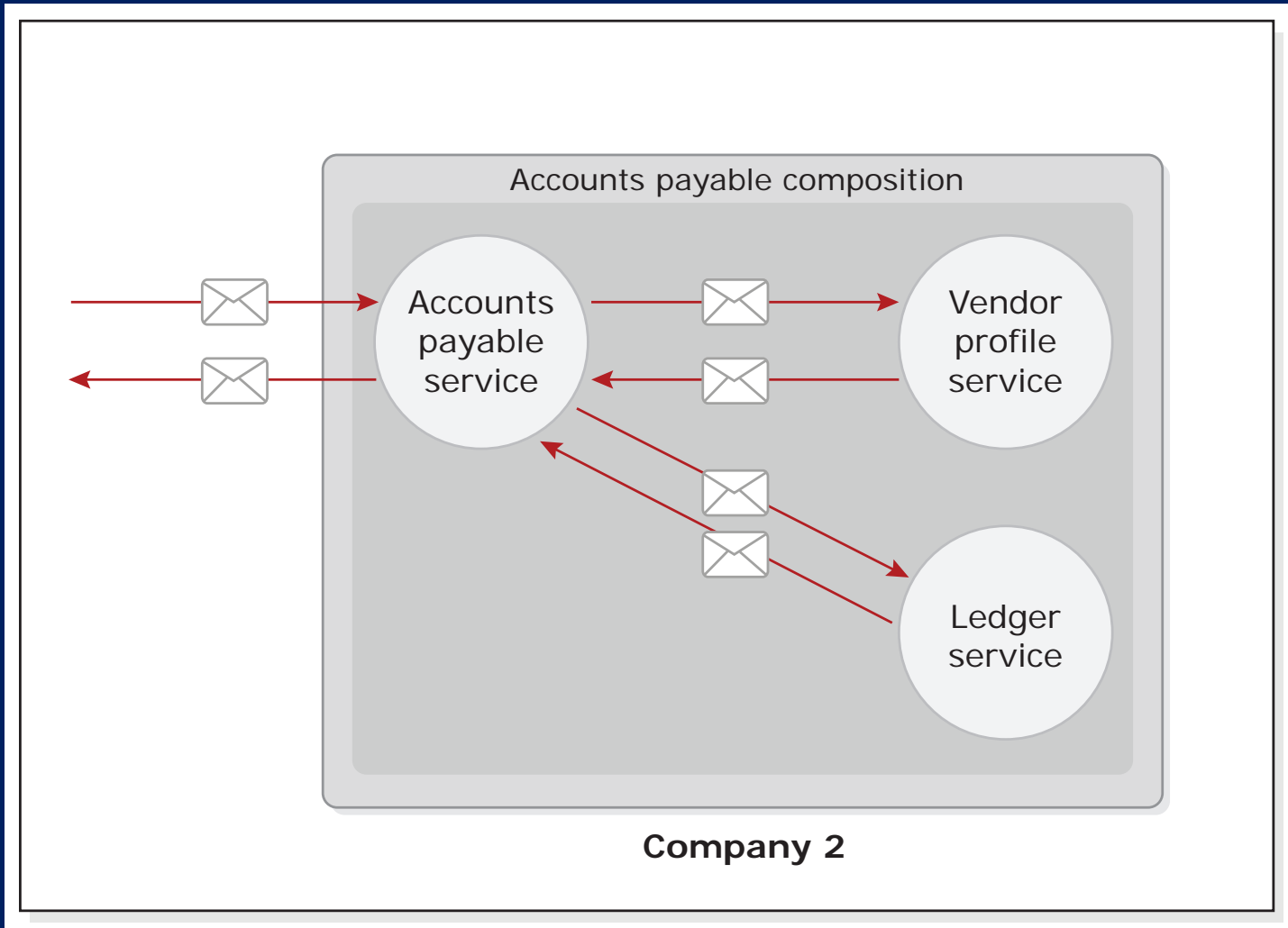Image by MIT OpenCourseWare.

SOA service composition

Image by MIT OpenCourseWare.

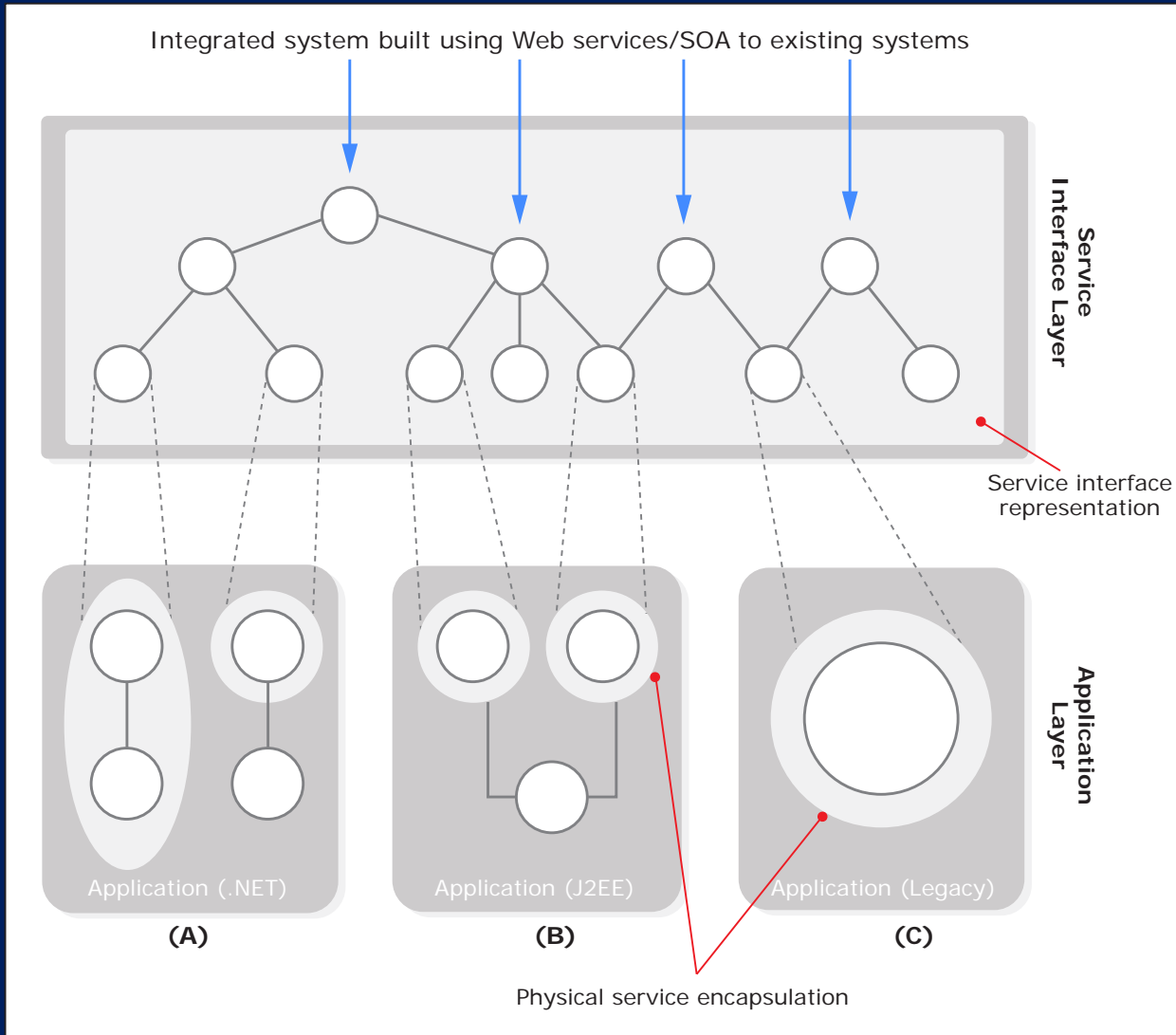# Web services and existing systems

Image by MIT OpenCourseWare.

Exercise

- **Draw an SOA diagram for your homework system**
- **Decide how you would structure your catalog browsing and ordering systems**
- **Draw your Web services**
- **Draw the Web services your customers would use to communicate with you**
- **Use Figure 5.4 and/or Figure 5.15 on the previous slides as a template**

Web 2.0

- **First generation Web services: SOAP, WSDL, UDDI (WSDL registry)**
  - **Met functional requirements for businesses, but not the supporting requirements: security, reliability, availability, quality of service, choreography**
- **Web 2.0: WS-* specifications:**
  - **WS-Addressing: references to Web service endpoint**
  - **WS-Atomic Transaction**
  - **WS-Business Process Execution Language**
  - **WS-Choreography Language**
  - **WS-Coordination and WS-Eventing**
  - **WS-Metadata Exchange Language**
  - **WS-Notification**
  - **WS-Reliable Messaging**
  - **WS-Security: end to end, not just point to point**
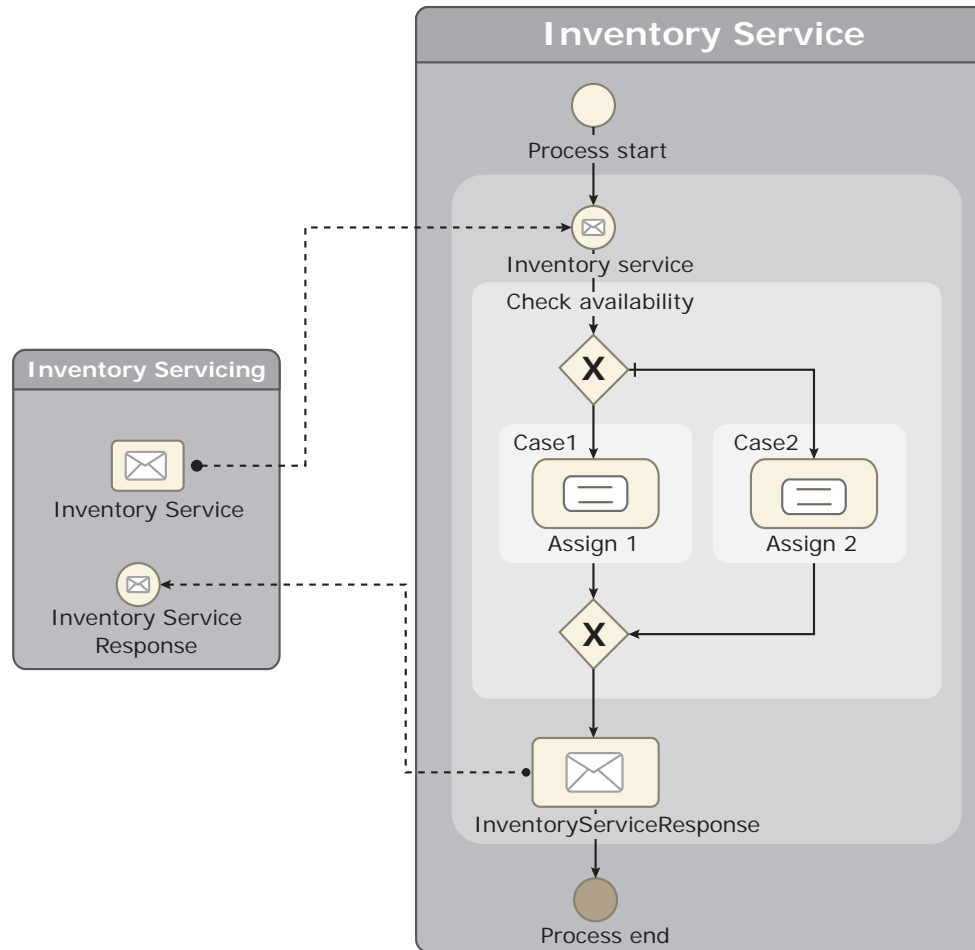
Business Process Execution Language

Image by MIT OpenCourseWare.

EDI (Electronic Data Interchange)

- **EDI is a mainframe-based standard for electronic exchange of information. Developed in 1980s.**
  - **EDI is expensive, complex and has limited usage, but enough that new technologies must interoperate with it**
  - **Typically, large companies use EDI and require it of their smaller partners/vendors, who are not always eager to use it**
  - **Two EDI standards: ANSI X12 and EDIFACT (UN)**
- **XML documents follow EDI standards in many cases**
  - **EDI documents are called Transaction Sets (TS)**
  - **EDI to XML mapping established using DTDs**
- **New users of Internet ecommerce may skip EDI and use XML**
  - **Less than 80,000 of 6-10 million US businesses use EDI**
  - **125,000 businesses world-wide use EDI**
  - **EDI cost and complexity are large obstacle for medium size businesses**

EDI

- **EDI communications:**
  - **Binary, not text (difficult to change or troubleshoot)**
    - **EDI transaction sets are static**
    - **EDI designed for expensive and scarce communications**
      - **Much optimization of message size, etc.**
      - **Intended to replace letters, phone calls, faxes**
      - **Not self-describing, cannot be validated, can't be extended…**
  - **Done through third party value-added networks (VANs)**
  - **Companies generally use file transfer to send file to VAN**
    - **VAN handles EDI exchange with trading partners**
    - **Geared to once-a-day, batch exchanges of data**
  - **Example (over a period of days): A purchaser:**
    - **Sends EDI 840 document (Request for Quote)**
    - **Receives EDI 843 (Quote)**
    - **Sends EDI 850 (Purchase Order)**
    - **Receives EDI 856 (Shipment Notice)**
    - **Receives EDI 810 (Invoice)**
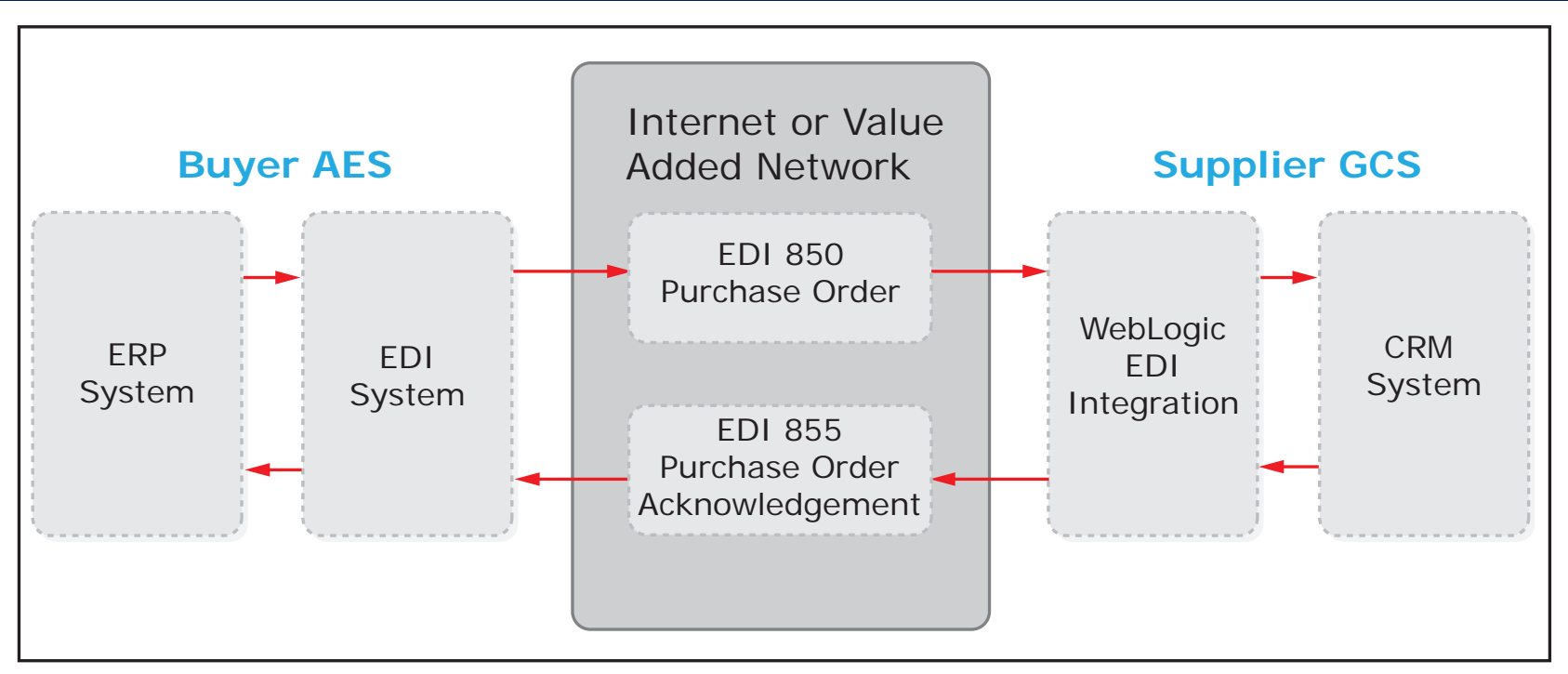   - **Sends EDI 820 (Payment)**

EDI and XML

Image by MIT OpenCourseWare.

EDI/XML translation

ISA - Interchange Control Header

Purpose: To start and identify an interchange of one or more functional groups, interchange related control segments.

Field	Element	Field Name	Req	Type	Size	Seagate Usage
ISA01	101	Authorization Information Qualifier	M	ID	2	00
ISA02	102	Authorization Information	M	AN	10	Not used by Seagate
ISA03	103	Security Authorization Information	M	ID	2	00
ISA04	104	Security Information	M	AN	10	Not used by Seagate
ISA05	105	Interchange ID Qualifier	M	ID	2	Trading partner qualifier
ISA06	106	Interchange Sender ID	M	ID	15	098533326 = Seagate production ID 98533326TST = Seagate test ID
ISA07	105	Interchange ID Qualifier	M	ID	2	Trading partner qualifier
ISA08	107	Interchange Receiver ID	M	ID	15	Trading partner receiver ID
ISA09	108	Date	M	DT	6	Current data: YYMMDD
ISA10	109	Time	M	TM	4	Current time: HHMM
ISA11	110	Interchange Standards Identifier	M	ID	1	U = ANSI X12
ISA12	111	Interchange Version ID	M	ID	5	00306
ISA13	112	Interchange Control Number	M	NO	9	Trading partner specified
ISA14	113	Acknowledgement	M	ID	1	0 = no acknowledgment 1 = interchange acknowledgment requested (always use 0)
ISA15	114	Test Indicator	M	AN	1	P = production data T = test data
ISA16	115	Sub-Element Separator	M	AN	1	Defined by sender

EDI Example

Retail information flows
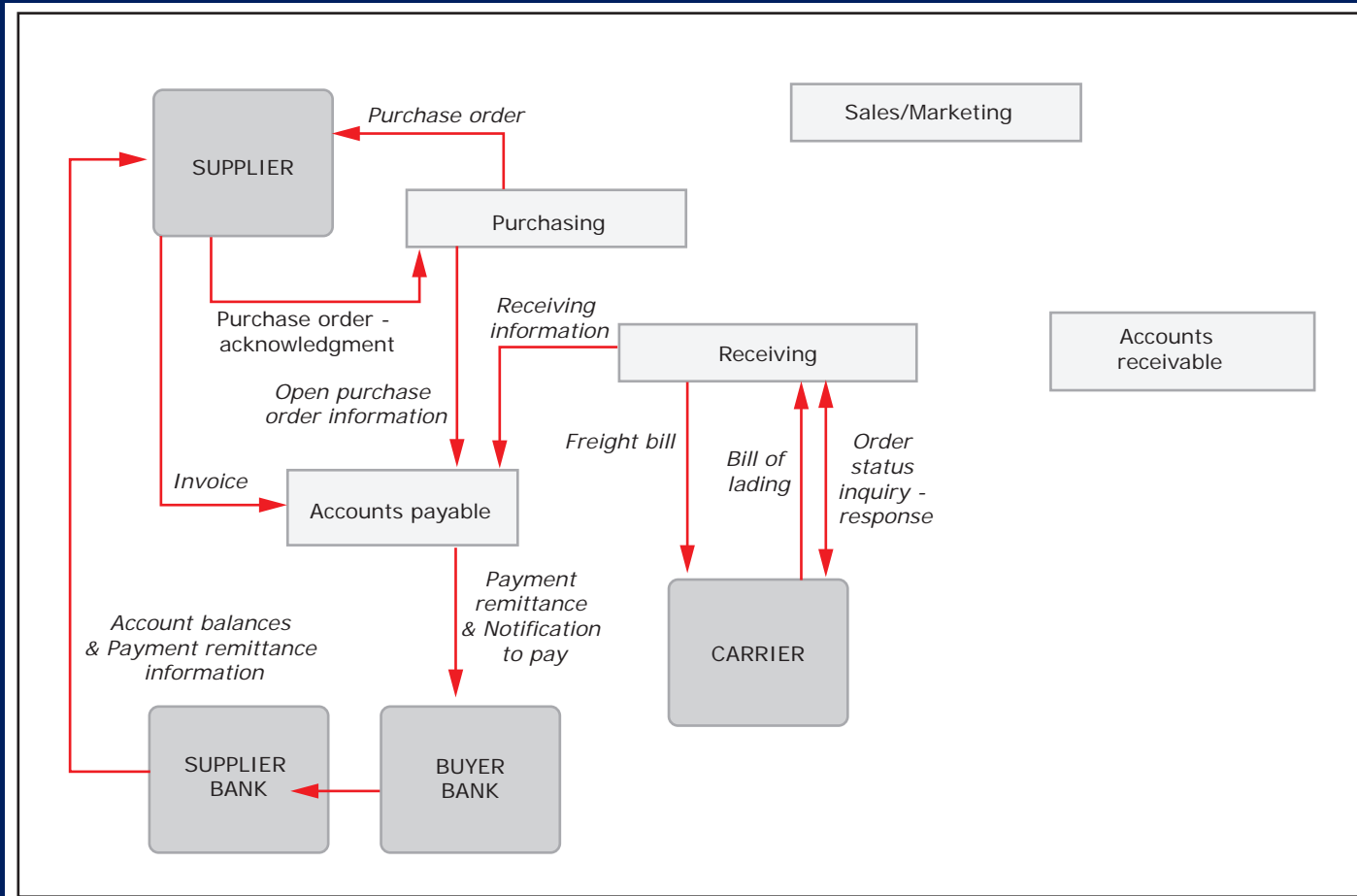

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Distributor information flow
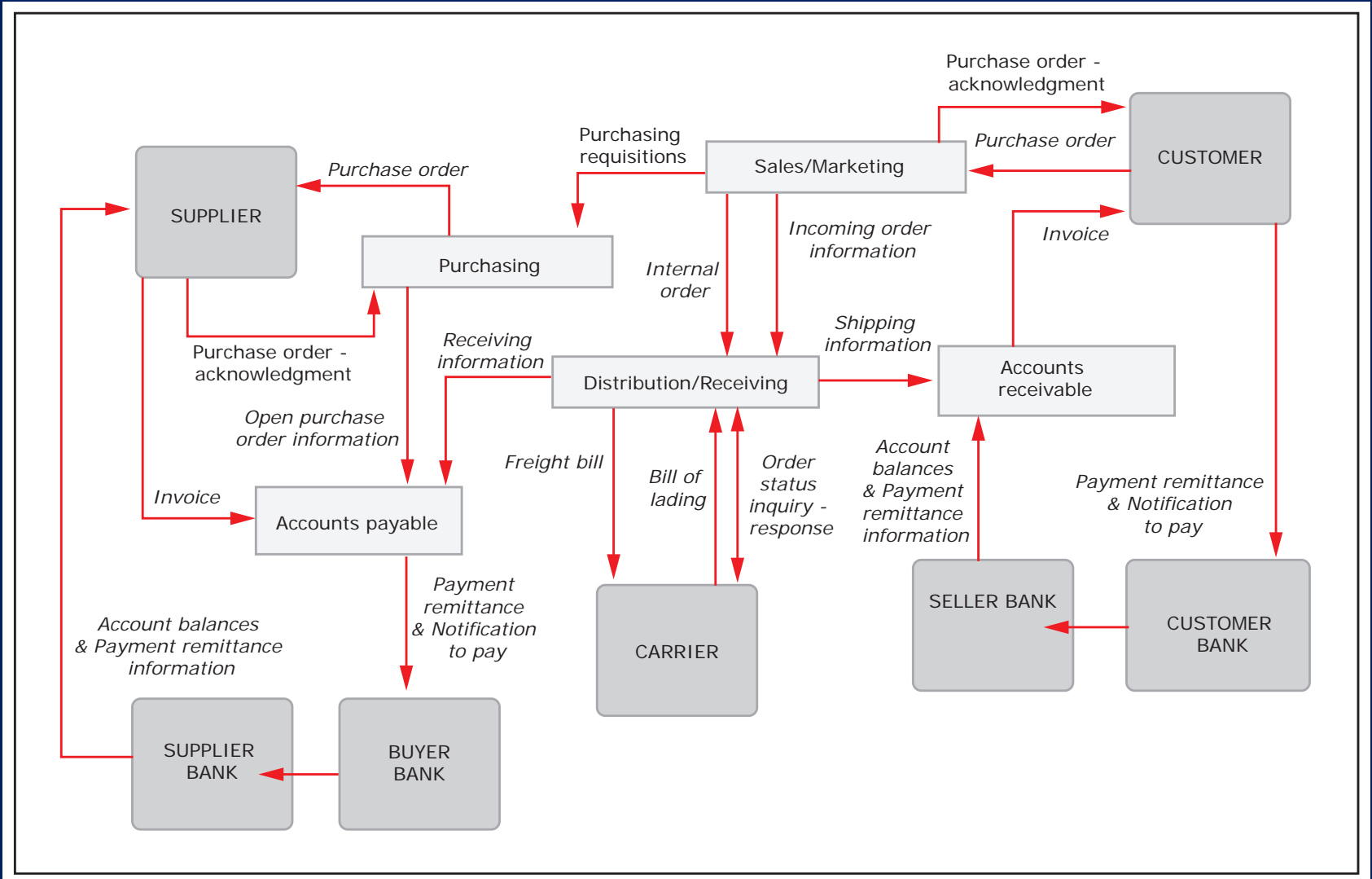
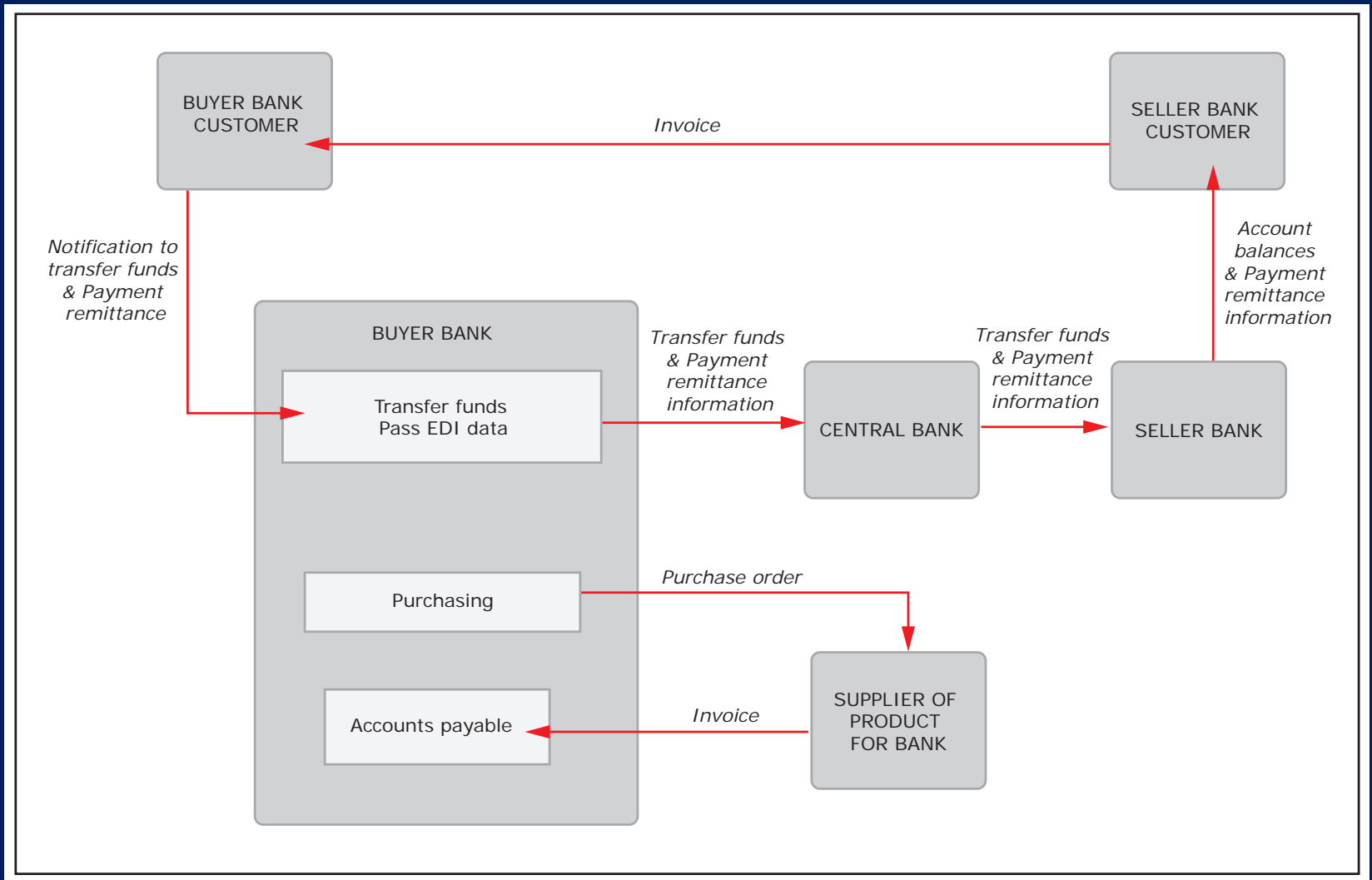# Financial information flow

Image by MIT OpenCourseWare.

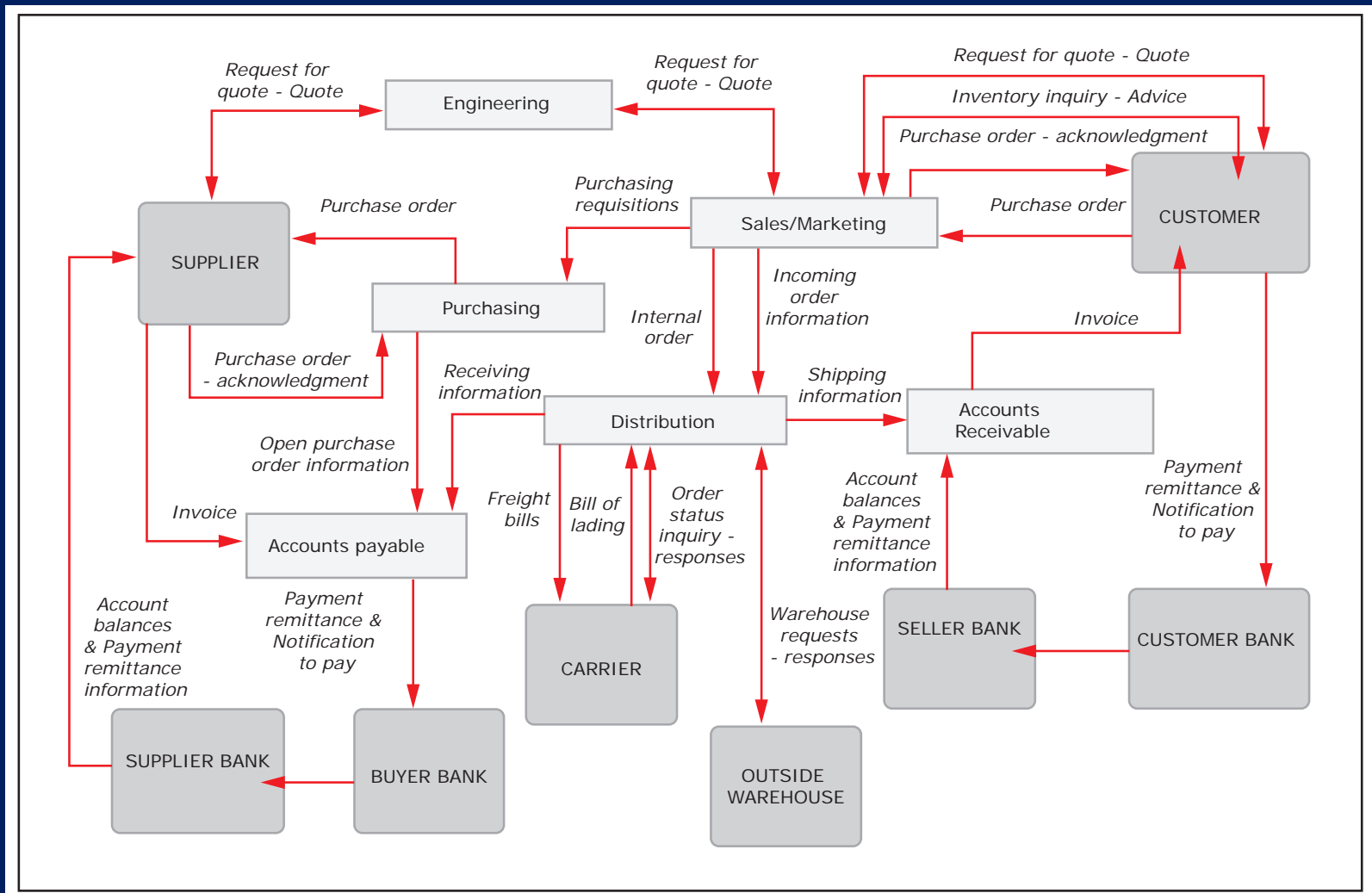# Manufacturing/engineering information flow

Image by MIT OpenCourseWare.

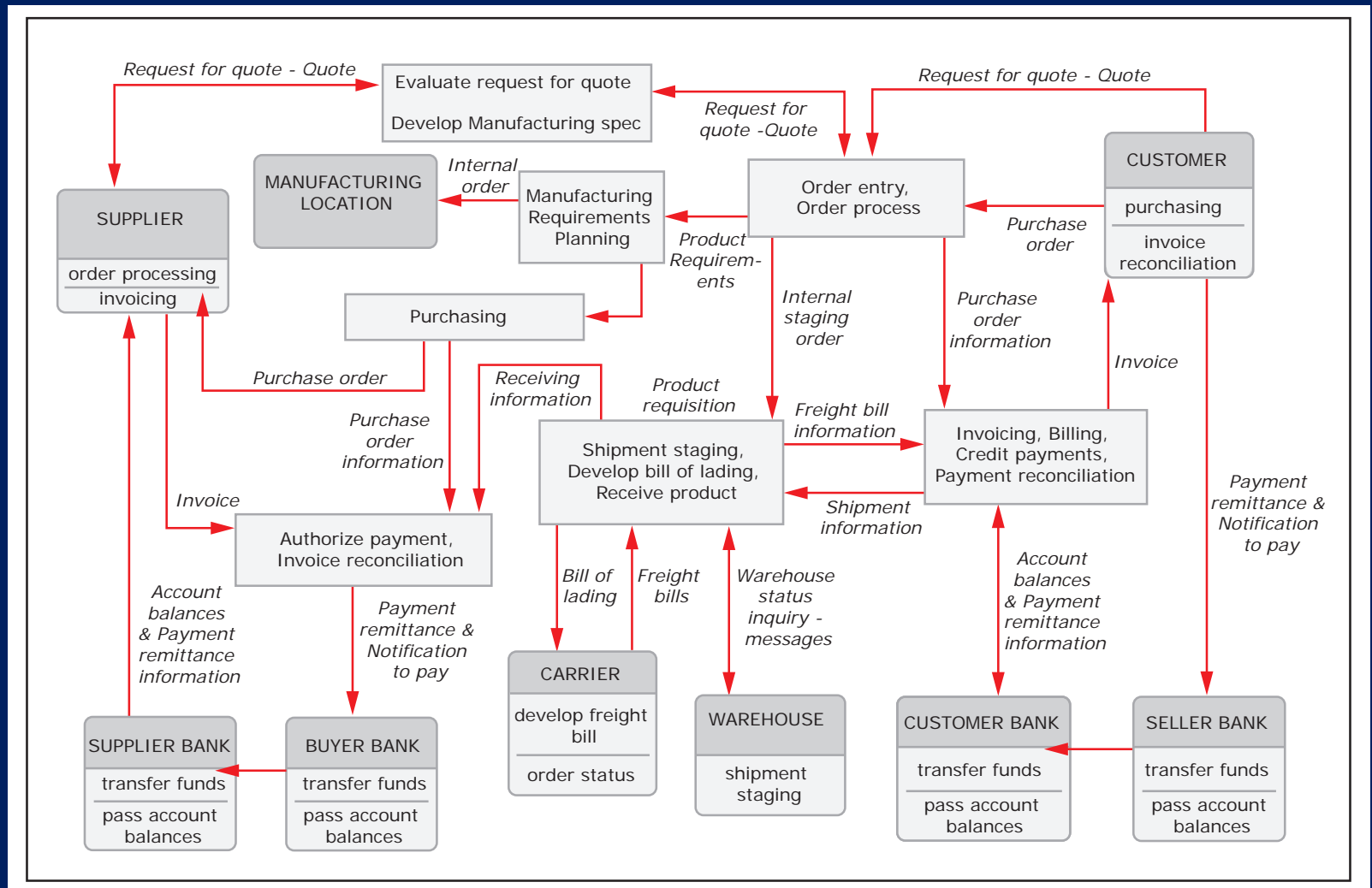# Manufacturer information flow: detail

Image by MIT OpenCourseWare.

ERP and EDI/XML standards

- **The previous slides define the core of an ERP system**
  - Many have very substantial additions for human resources, planning, etc.
  - You can buy a full ERP or mix and match best of breed systems. Web service/SOA integration is common.
- **Almost every interface on the previous slides has a defined EDI or XML transaction set or message set, typically defined by industry**
  - TDCC (1968), EDX, CDIX, TALC, UCS/VICS, WINS, BVAI and others

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