Web Data Modelling (ISM)

Web-based Systems:
Data Modelling,
On the Web,
Web Applications,
Web Developments

Web Services
Lecture Meeting 2

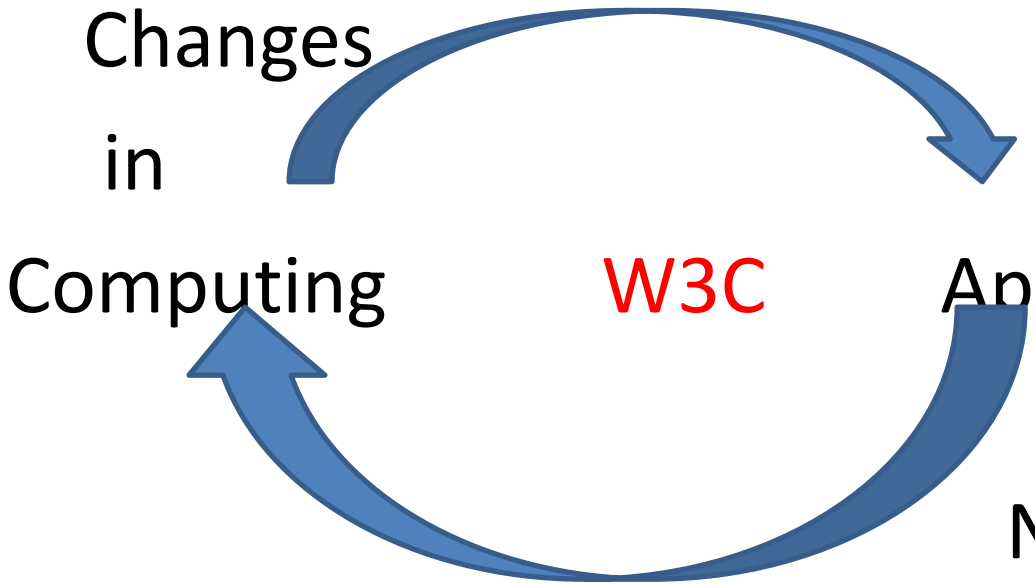
S. Bhalla, (2024)

Computing in Governance

- Early Applications → Public needs (Governments) → Weather prediction, Census data , …, Military,
- Computing Technology → Scientific computing
- Application Changes → Agriculture (Radio broadcast, TV, Bulletin Boards, Village seminars and fairs), Now → Web Applications

- Technology → Change is fast (Quantum Comping)
- Problems → Enormous size and numbers (Biology, Astronomy, Finance and Transaction Control activity in Banking, insurance, business)

Web-based Computing as enterprise (1993 - to date)



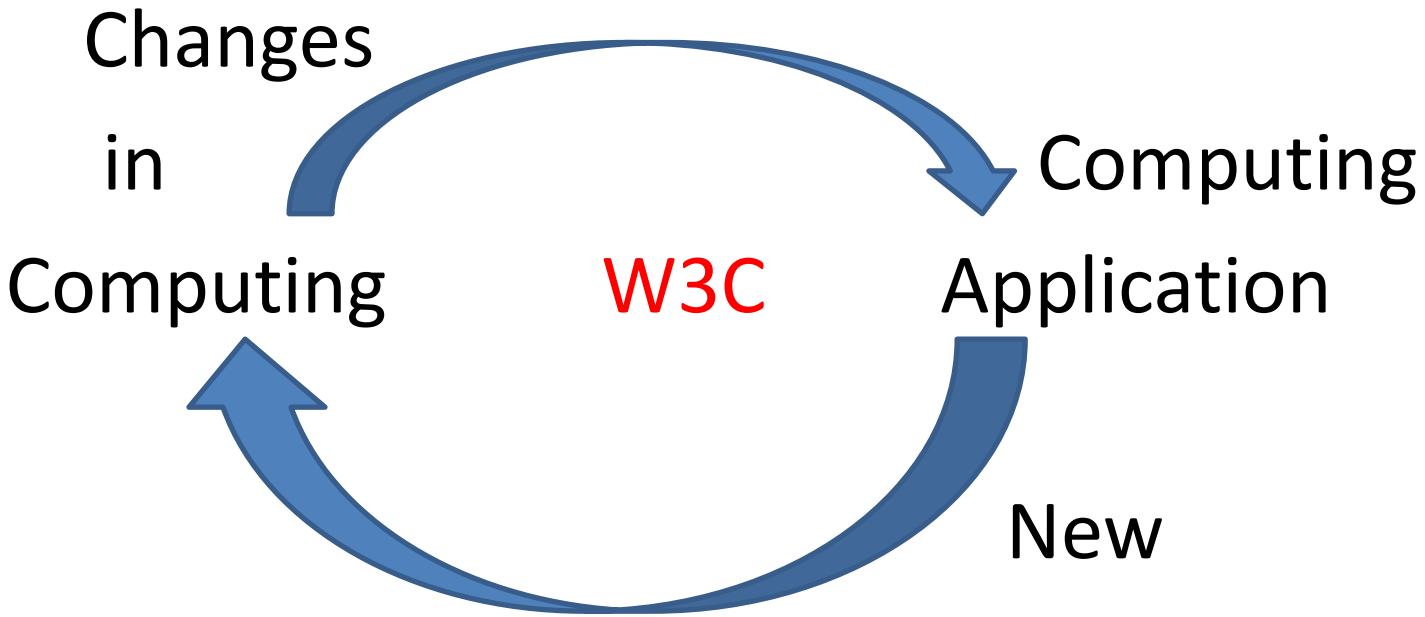
- New
- Specifications

Computing as enterprise
(25 Years before 1993)

- **Prior to 1993**:
- Database System
- Distributed Systems on ETHERNET (web?,internet?)

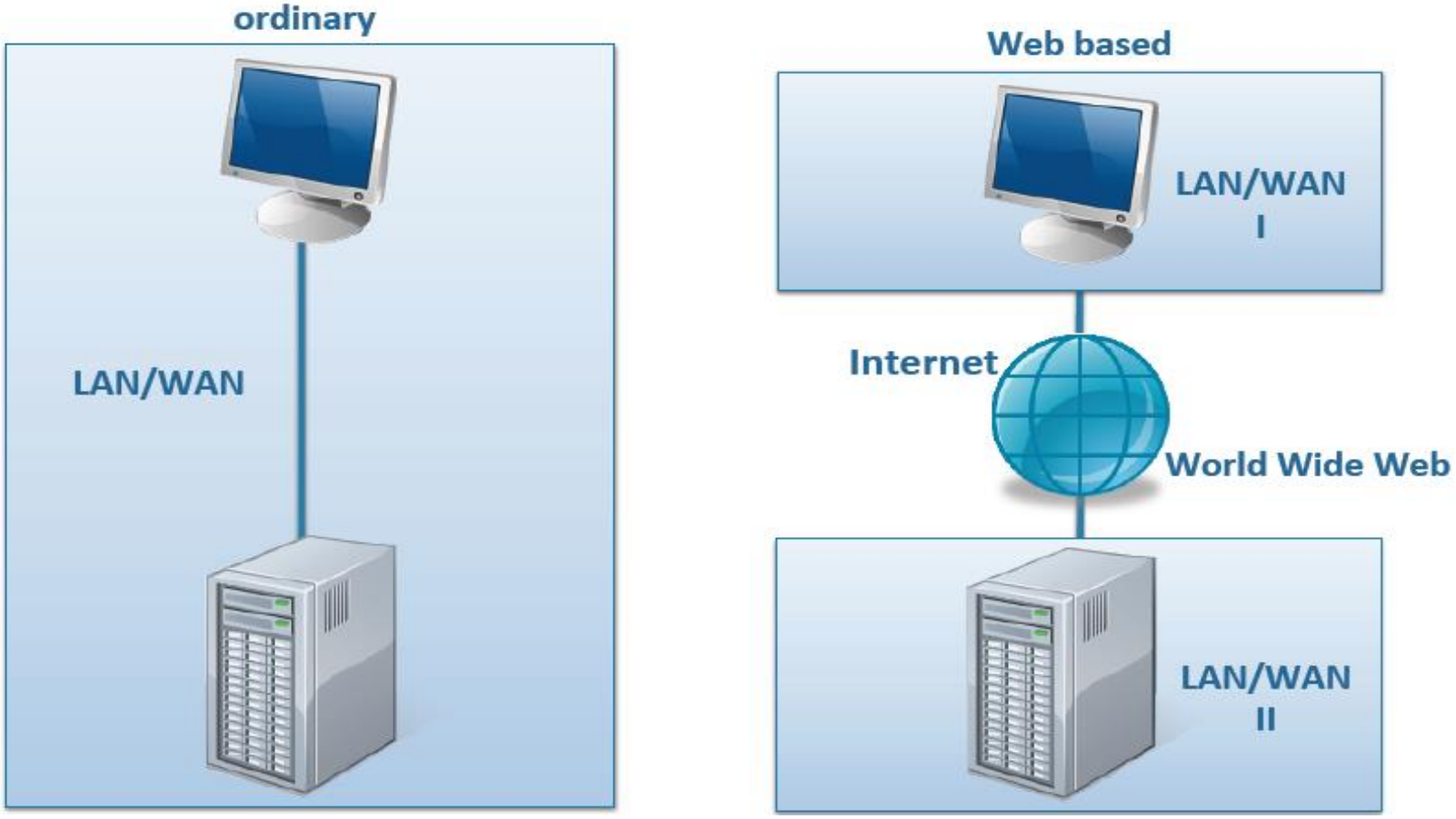
– Banking, Stock exchange, Airlines, Railways,…

Web-based Computing as enterprise

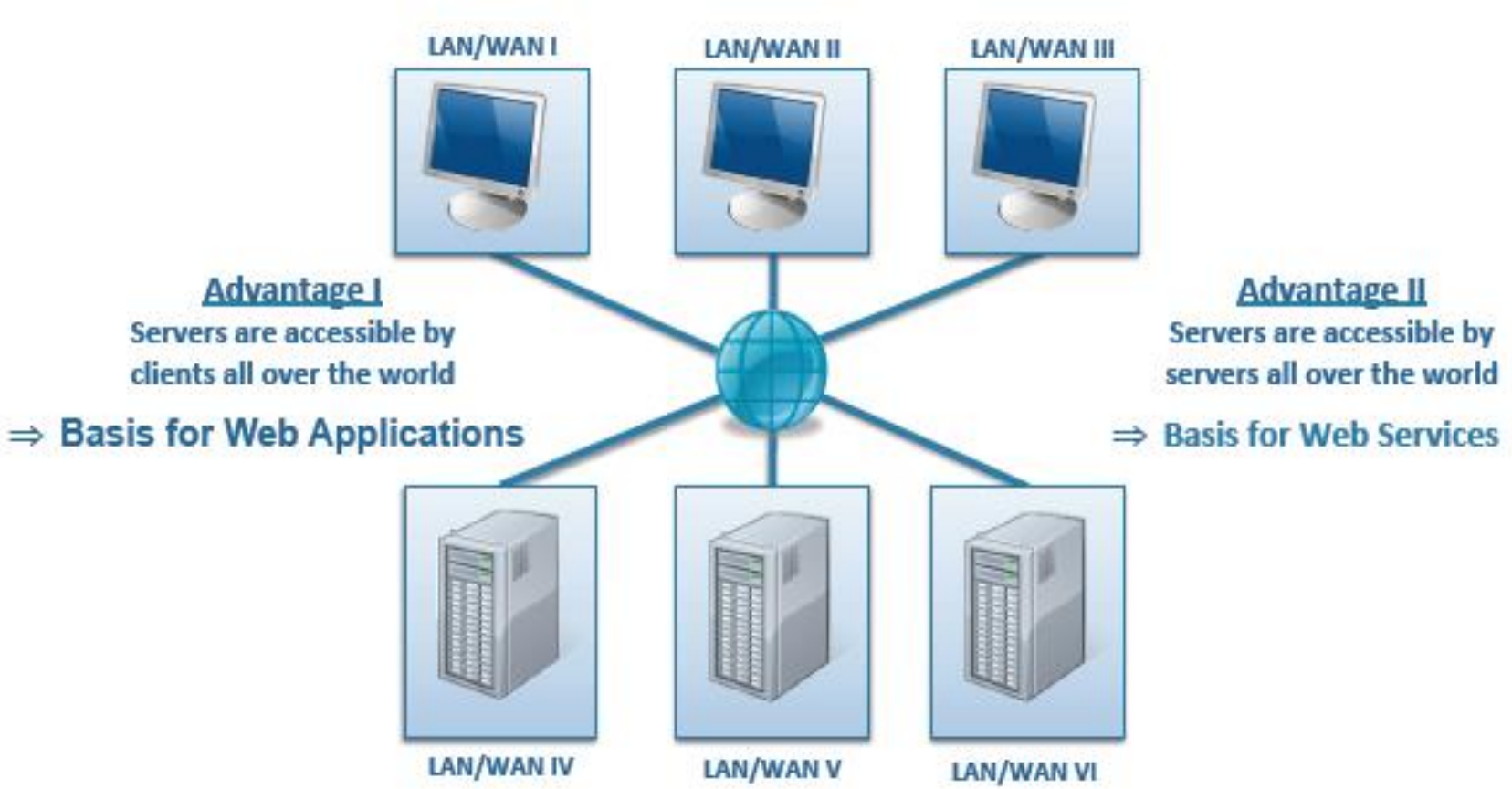


- Database, Distributed Systems on Networks

Client Server Systems



Web-based Client Server Systems



Web Engineering: Service-Oriented Architecture (SOA)

- Definition by Pressman(*) :

Web Engineering (WE) : SOA

→ applies sound scientific**,** engineering, and management principles,

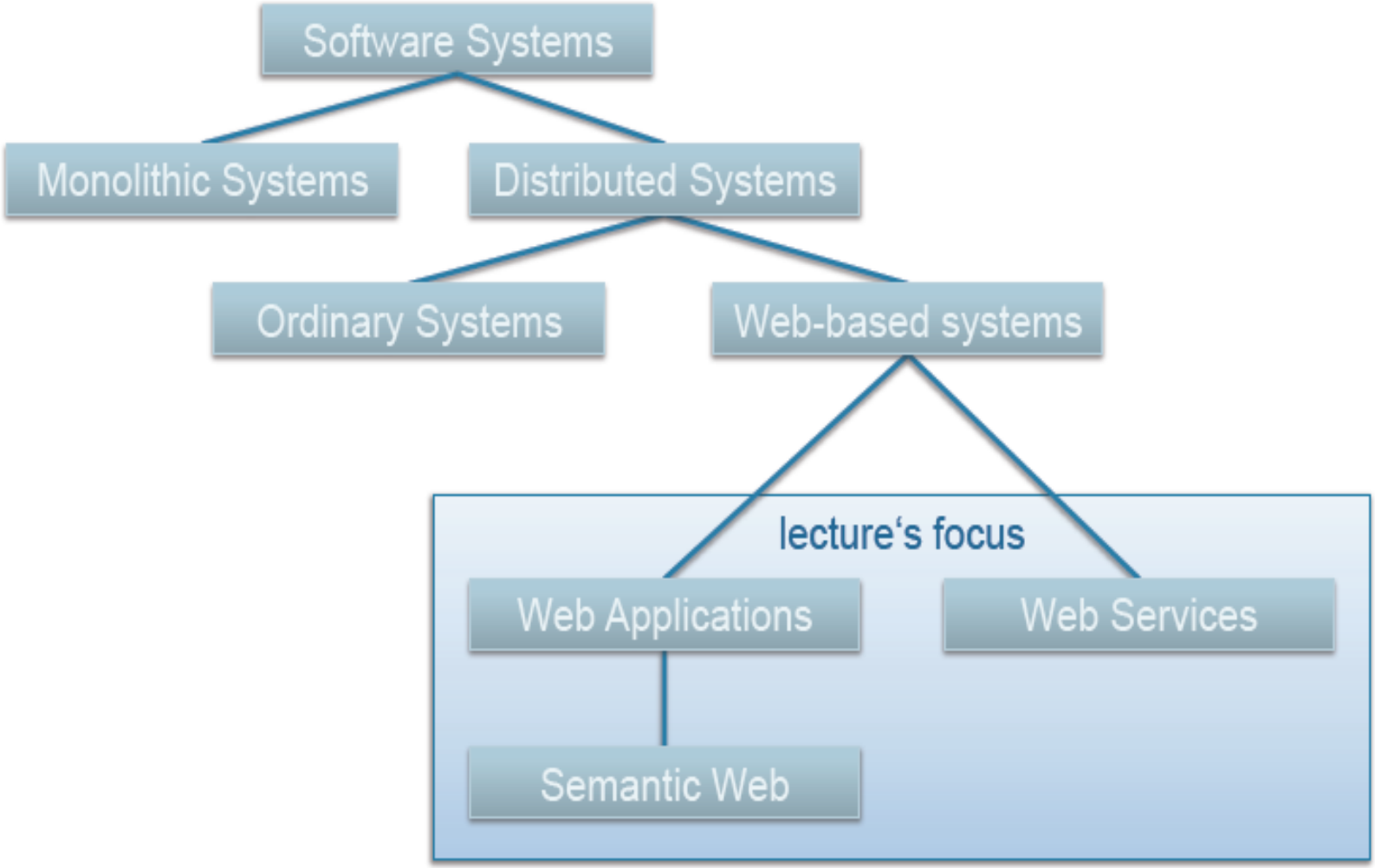
→ disciplined and systematic approaches to the

successful development,

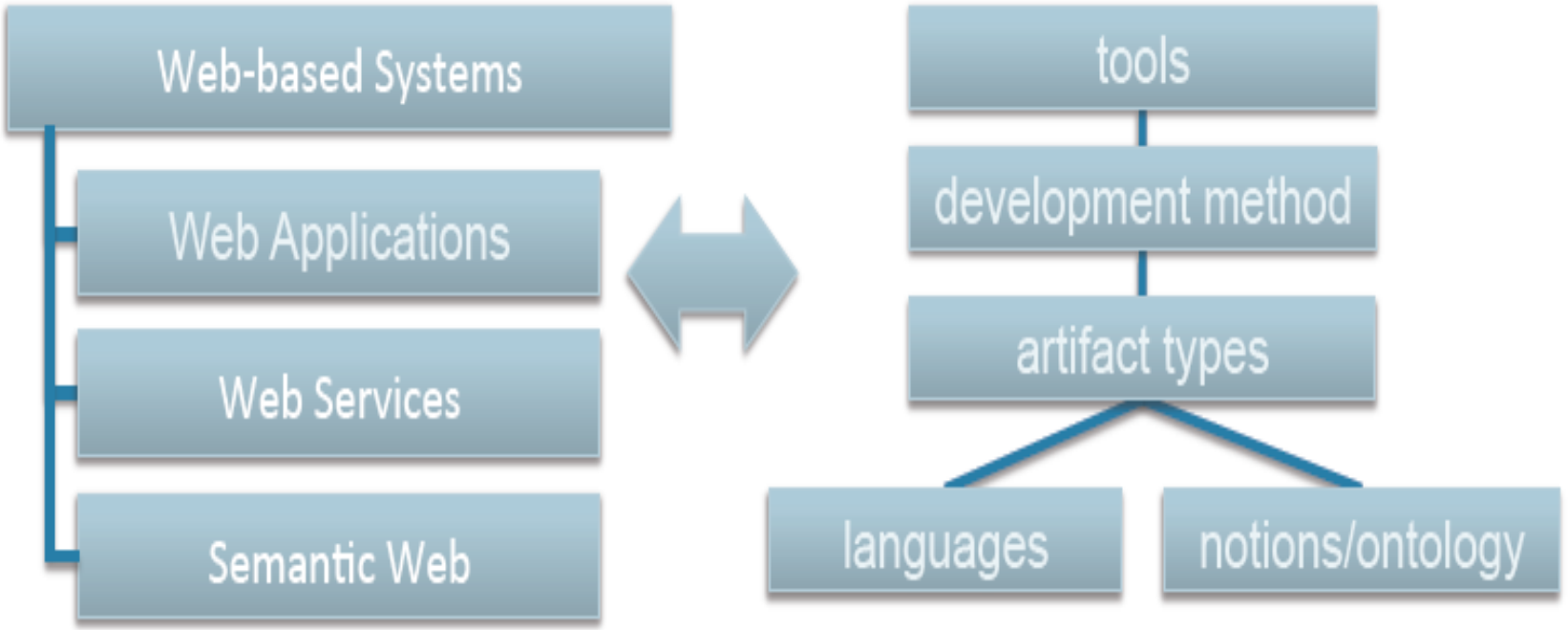
→ deployment, and maintenance of high-quality web-based systems and applications.

- (*)R. Pressman: Software Engineering – A Practitioner's Approach, 8th Edition. McGraw-Hill Higher Education 2014

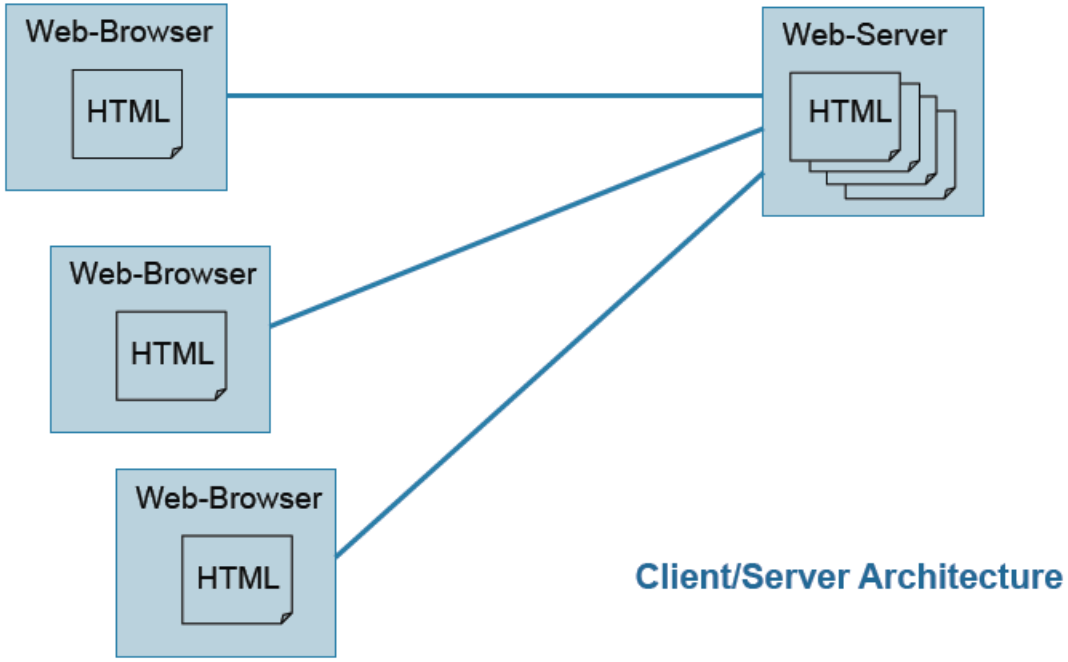
Software Systems



Web Engineering: Service-oriented Architecture



Conceptual Architecture



History of the Web

1969: ARPA (Advanced Research Projects Agency)

– First small network: Stanford Research Institute, UCLA, UC Santa

Barbara, Univ. of Utah

– TCP (Transmission Control Protocol)

– IP (Internet Protocol)

- 1972: Telnet protocol
- 1973: SMTP (Simple Mail Transfer Protocol)
- 1973: FTP (File Transfer Protocol)

- 1989: T. Berners-Lee et al.:

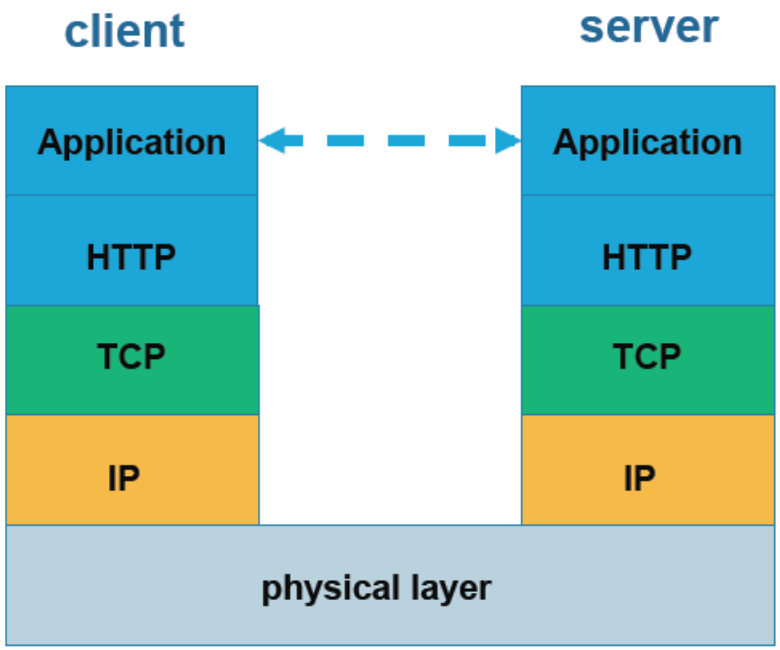
Word Wide Web (WWW)

- 1994: W3C (World Wide Web Consortium)
- 1996: HTTP (HyperText Transfer Protocol)

Internet - Web

- Internet Protocols
- SSH Secure Shell, ……
- SMB Server Message Block, CIFS (Common Internet File System)
- FTP File Transfer Protocol, SMTP Simple Mail Transfer Protocol
- TCP Transmission Control Protocol, Telnet Telephone Network
- HTTP Hyper Text Transfer Protocol
- HTTPs Secure Hyper Text Transfer Protocol
- POP Post Office Protocol, HTCPCP Hyper Text Coffee Pot Control Protocol, MTP Media Transfer Protocol
- SFTP Secure File Transfer Protocol, SSL Secure Socket Layer
- -…..
- ----------
- WEB → HTTP, HTTPS

Protocol Stack



World Wide Web Consortium (W3C)

- international consortium→ member organizations, a full-time staff, and the public
- work together → develop Web standards

- http://www.w3.org

- W3C's mission:
- → **to lead the WWW to its full potential**
- →**by developing protocols and guidelines that ensure long-term growth for the Web.**

Web Application

- **Definition:**

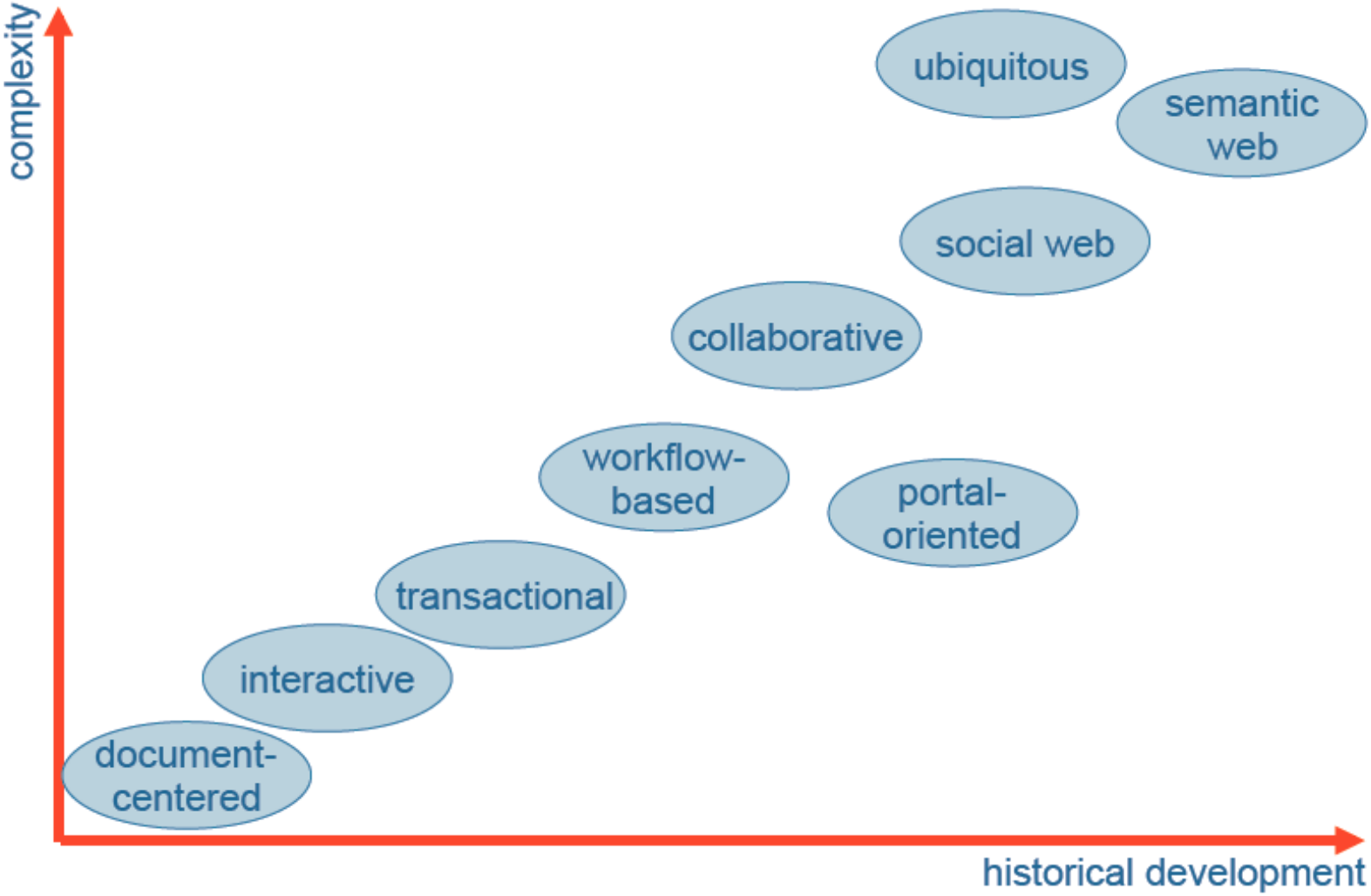
→A **Web Application is a software system based on** technologies and standards of the World Wide Web

Provided by:

- Consortium (W3C) that provides Web specific

resources → content and services through a user interface, the Web browser

Categories of Web Applications



Supporting Developments I

- HTML 0 → Web Pages and URLs
- Web search
- Most common use → a Catalogue, Bus Time Table

- HTML 1 → Forms
- XML → XHTML (tags → CSS templates)
- Client Side ←→ Server Computing
- Forms ←→ Web server
- JavaScript (Clent-Side) Language

Supporting Developments I

- HTML 0 → File in return for a URL address
- HTML 1 → Server executes a program for service

- .. HTML 4, .. HTML 4.3 ,,. .
- Memory-less web servers
  + HTML/HTTP Cookies

- Web Services (Server to Server Computing)
- HTML 5 → X,Y coordinates
- Semantic Web → SPARQ , RDF , ontology

Changes in Web-based Computing

- HTTP and HTTPS speciffications
- HTML 0 ,.. . .. , HTML 5
- Supporting servers for services, Web services, Cloud Computing…
- IT and Communications (4G, 5G,..) → ICT (Information and Communication Technology)

Categories of Web Applications (1)

- (cf. Pressman, p. 472, Kappel, p.5)

- **document-centered (HTML 0)**

→ Informational

- read-only content is provided with simple navigation and links

→Download

- a user downloads information from the appropriate server (ftp-server)

→ Customizable

- the user customizes content to specific needs

- – **examples:**
- • static HTML-pages, „home pages“
- • web radio
- • simple presentations of companies/products

Categories of Web Applications (2)

- **Interactive (HTML 1)**

→ content of a website is dynamically generated as response to a user

- request

→ form-based input is the primary mechanism for communication between client and server

→ usage of HTML-forms and Common Gateway Interface (CGI) techniques

- • radio button, string input, choice lists

- – **examples:**
- • dynamic HTML pages
- • public transport schedules
- • search engines

1. HTML specifications → FORM feature
2. **Browser (HTML) → Web-Server → CGI Program**

Categories of Web Applications (3)

- **Transactional (HTML 1 or later)**

→ complex interactions

→ read and write actions

→ atomicity / roll-back in case of problems

→ usage of transaction management of database systems

• efficient and consistent data management

• • structured data and queries

• – **examples:**

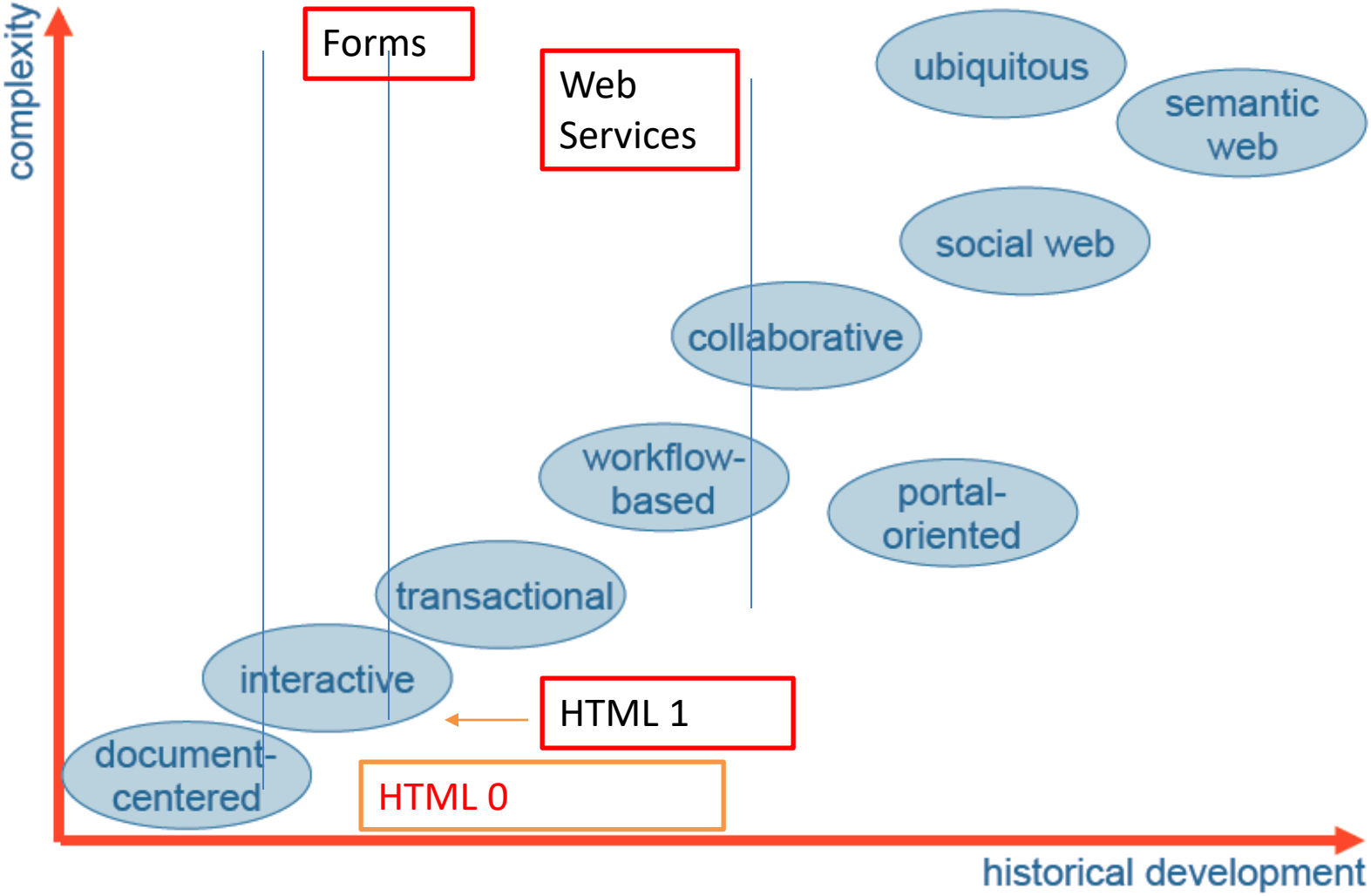
• online banking

• e-shopping

• reservation systems

REQUIRES → Web Services support

Categories of Web Applications



Categories of Web Applications (4)

- **workflow-based**

→ support business processes (“workflows“) within respective units between different enterprises or private users

→ an application provides a complex service to the user, e.g. assists the user in determining the mortgage payment

→ prerequisite: structured flow of activities

– **examples:**

- Business-to-Business (B2B) Integration Frameworks
- E-Government
- patient workflows in health care systems

REQUIRES → Web Services support

Workflow Examples

Workflows are (the computerized part of) **business processes**,

→consisting of a set of (automated or intellectual) **activities**

→ with specified control and data flow between them (e.g., specified as a state chart or Petri net)

Workflow Examples

Conference travel planning:

- Select a conference, based on subject, program, time, and place.
  If no suitable conference is found → the process is terminated.
- Check out the cost of the trip to this conference.
- Check out the registration fee for the conference.
- Compare total cost of the conference → to allowed budget,
  → and decide to attend only if the cost is within the budget.

Observations: activities spawn transactions on information servers,

workflow state must be failure-resilient,

long-lived workflows are not isolated

Workflow Examples

- Transactions
- Workflows

- RPC based Systems: Banking, ATMs (LAN, dedicated lines)

- Web Services Based Systems (now, in future) :
- Car company and part suppliers, AMAZON and its suppliers ← closed group
- Paytm, yahoo auctions ← open groups

Categories of Web Applications (5)

- **collaborative**

→ support cooperation in case of unstructured flow of activities and high degree of communication

→ "groupware"

– **examples:**

- support of shared information- and workspaces

– Wiki, http://c2.com/cgi/wiki

– BSCW, http://public.bscw.de/

– Microsoft Windows SharePoint Services

– chat rooms

- e-Learning platforms: Khan Academy

LIVE OBJECTS !

Categories of Web Applications (6)

- **portal-oriented**

→ the application channels the user to other Web content or services outside the domain of the portal application

→ "single point of access"

– **examples:**

- community portals

– dedicated user groups

– customer profiles

- enterprise portals

– Intranet, extranet

Categories of Web Applications (7)

- **social-web**

→ people provide their identity to a community of others with the same interests

– serve the purpose of finding other people

– **examples:**

- weblogs
- networking platforms

– XING, facebook

- virtual shared workspace

Categories of Web Applications (8)

- **ubiquitous**

→personalized services at every time at every location

→ multi-platform delivery (PC, PDA, mobile phone)

→context-dependent information

– **example:**

- **display of today‘s menu on end-user devices while entering a restaurant**

Categories of Web Applications (9)

- **semantic web**

→ Extension of the WWW

• WWW links data (Hypertext)

• Semantic Web links data on the basis of its meaning

→ Information available on the web

• adequate for human understanding and

• adequate for automatic manipulation

→ “knowledge management“

• derivation of new knowledge

• re-use of knowledge

• based on ontology’s

– Example:

• Google, semantic web content management systems

Summary

- 1. Web Applications → Support Business Activities

→ →E-commerce and Production Systems (Electricity Distribution)

- 2. Government Support Programs
- Education
- Healthcare and Life (Air-traffic Control)
- Defence Services
- : Scientific Evolution for critical applications

→Security, Overheads, Long duration Transactions, workflows

→ Specifications: Form, client-Server, Web Services, HTML 5 (transmitts GIS coordinates of clients), tracking tools/systems

Chapter Exercise (Submission → 1 week)

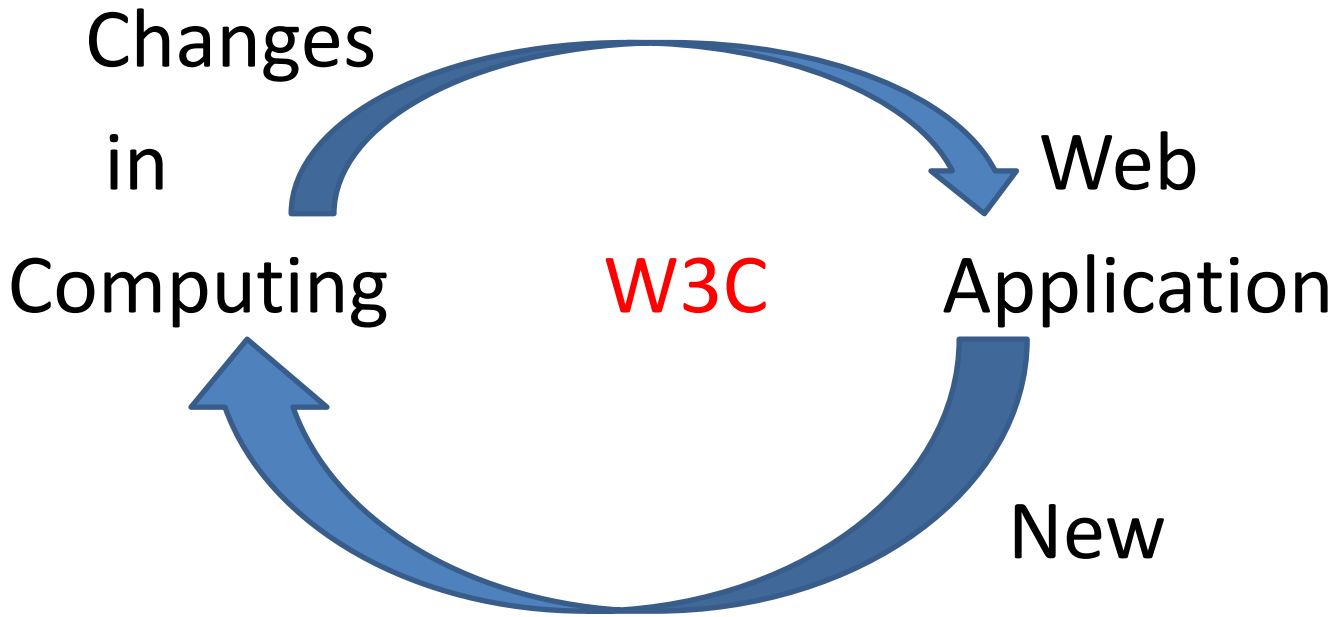
- 1. Get the details of listed web sites and terms (in this set of slides).

- 2. Classify the following web applications:

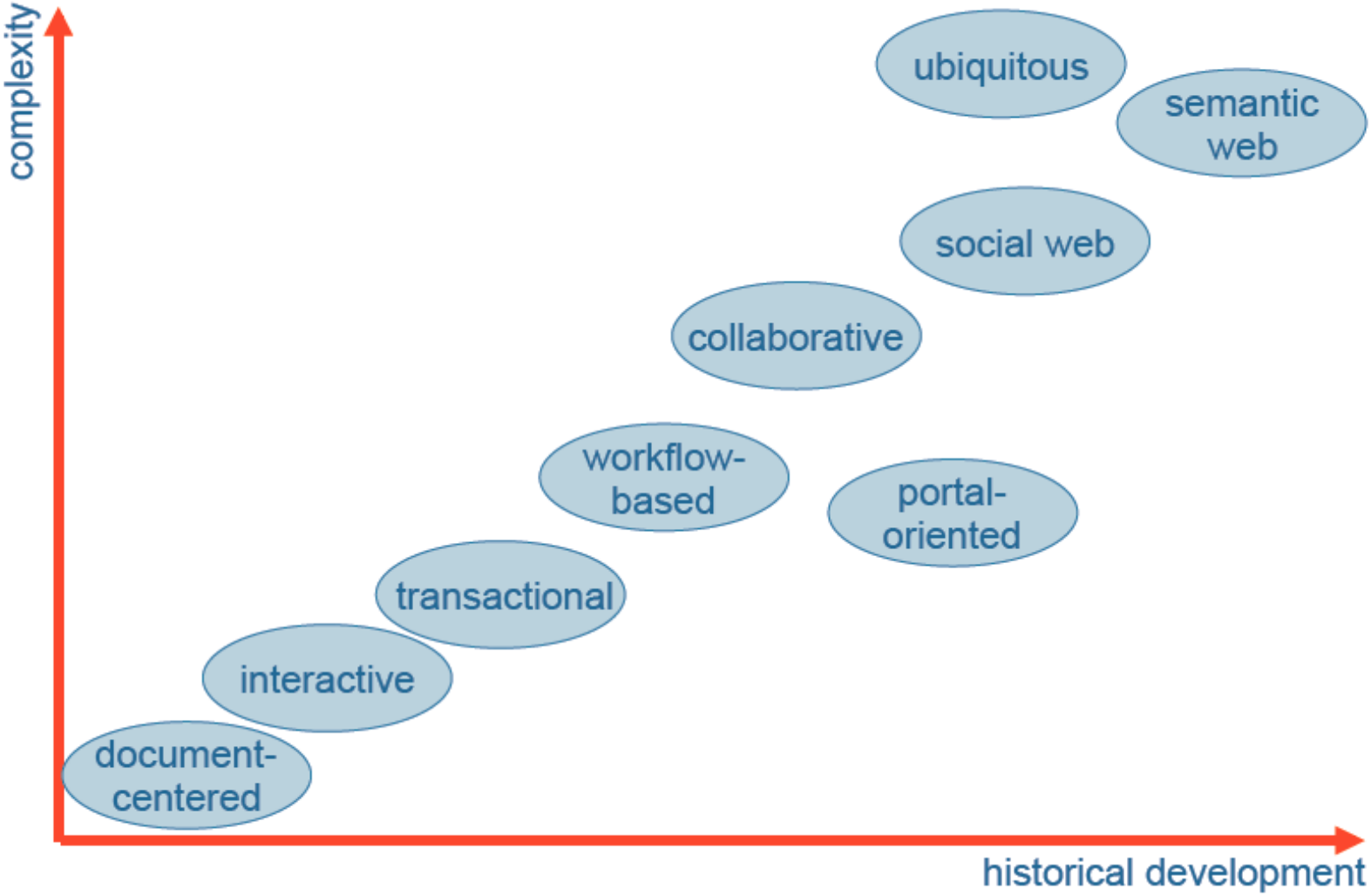
→SkyPe, MedlinePlus, MedlinePlus Encyclopedia, Google Docs, Google Maps API, gmail, LMMP (NASA), Facebook, Twitter, LinkedIn, JAL home page, IITD home page, AMAZON, Any e-auction web site, Postgres web site, Wikipedia.

→Google Meet, zoom, Microsoft teams

Web-based Computing as enterprise



Categories of Web Applications



Computing as enterprise (before 1993 - 25 years)

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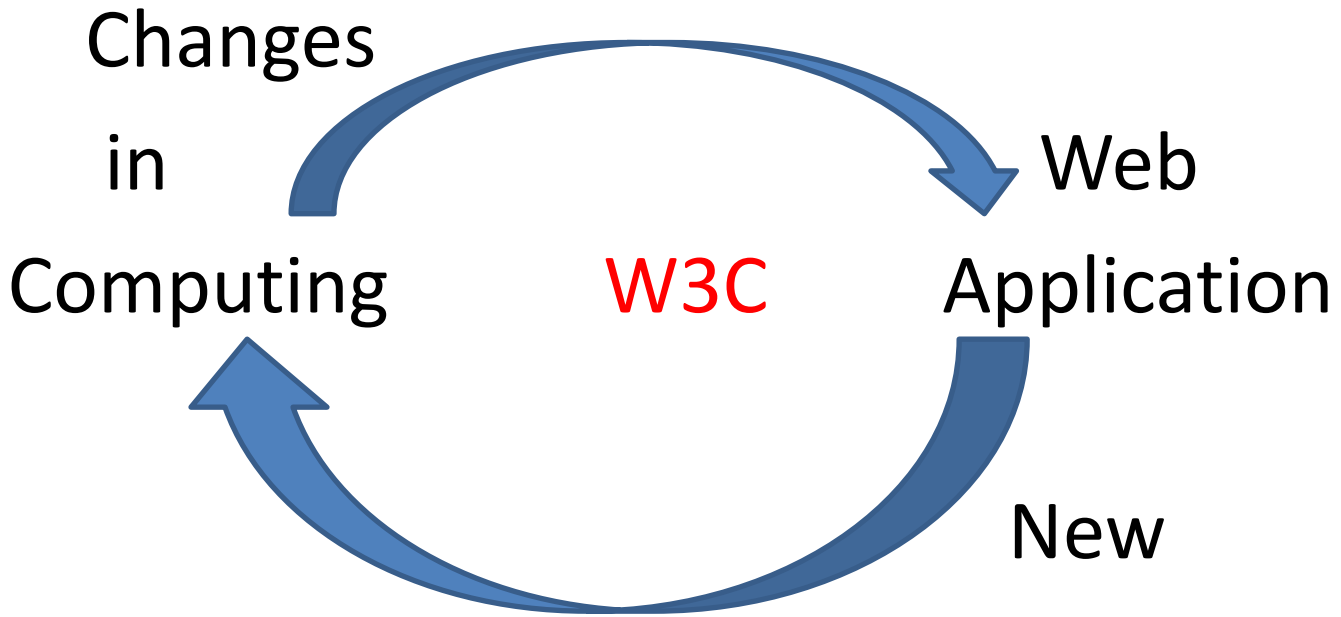
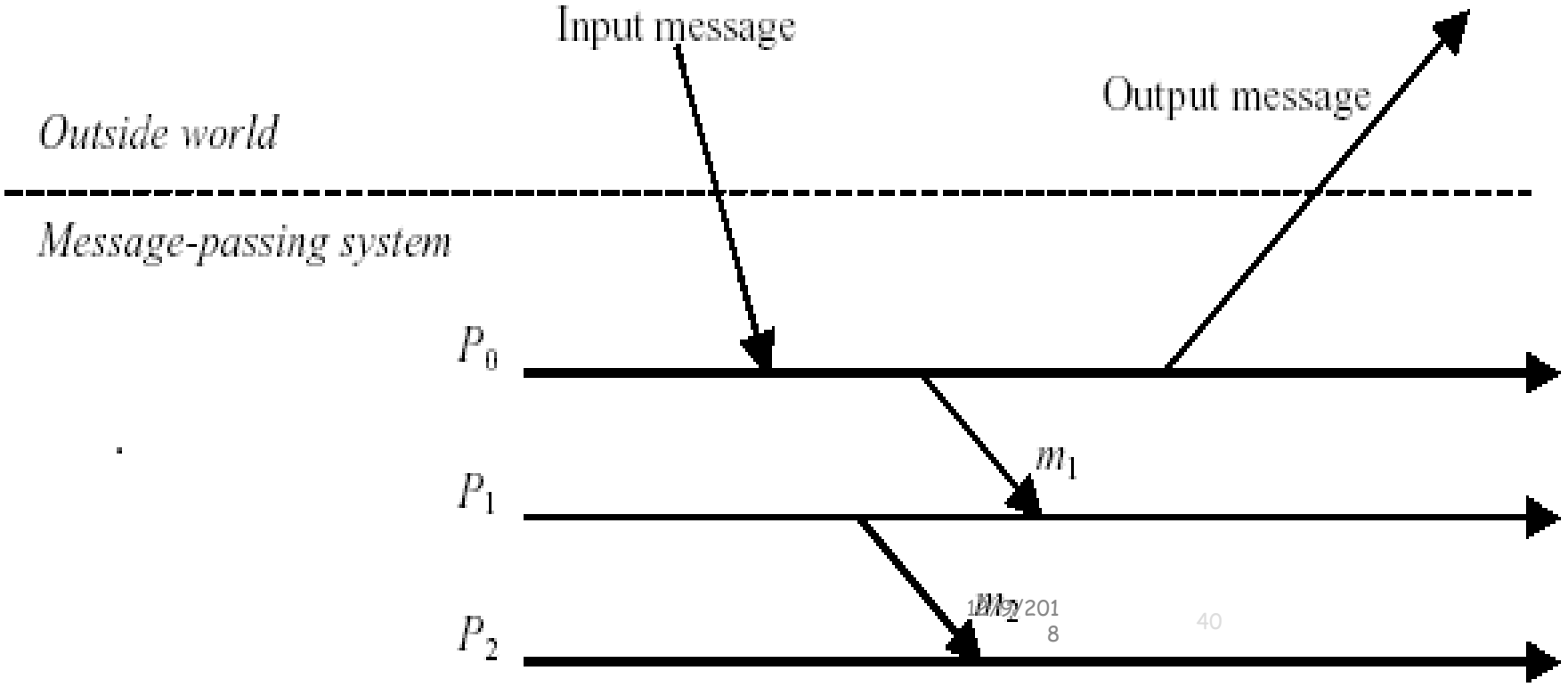
Web-based Computing as enterprise

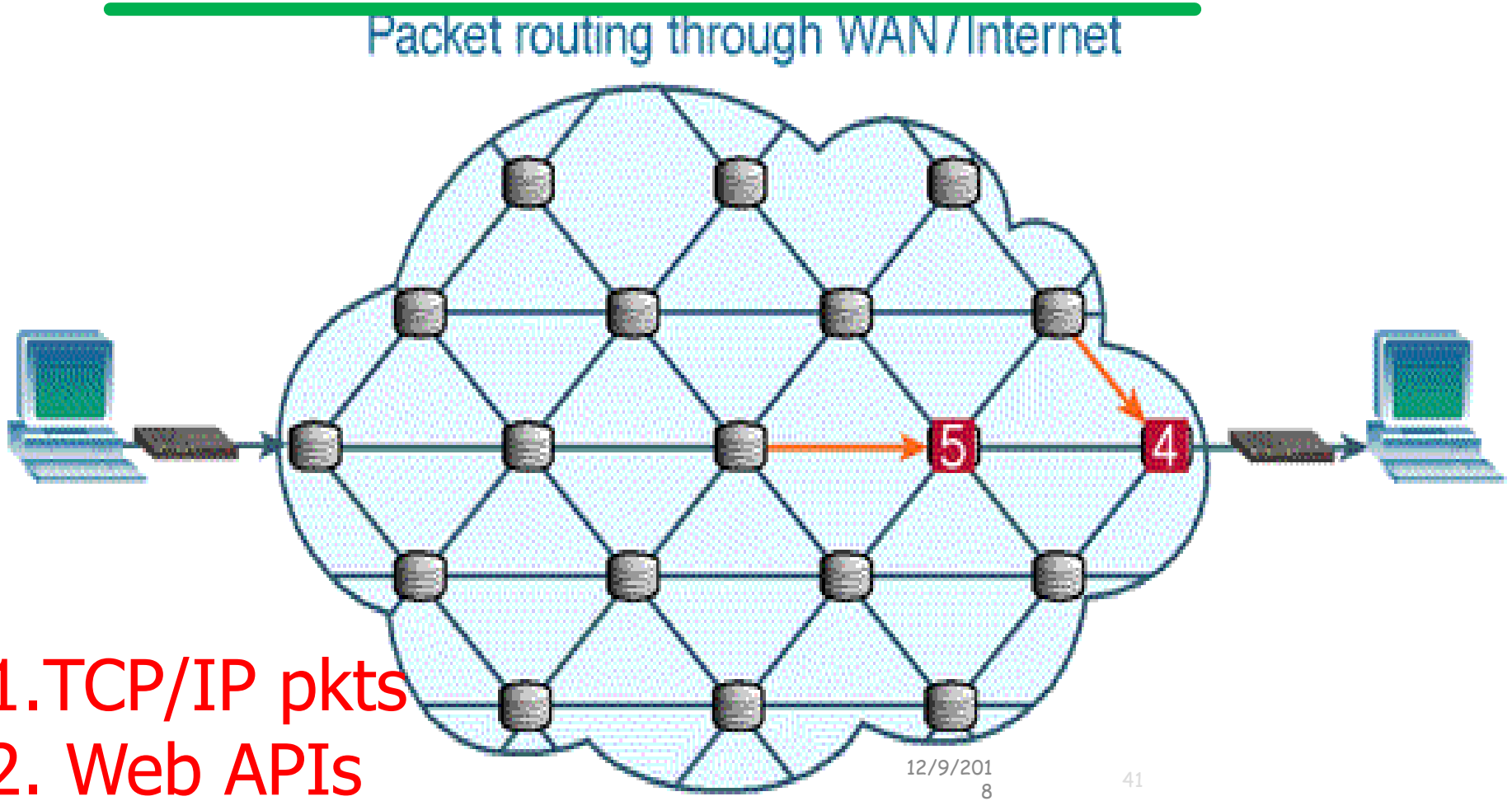


Interactions thru the Web

- A number of processes (N) on ETHERNET
  - Communicate through **messages to Cooperate**
  - **Interact with outside world (web)**

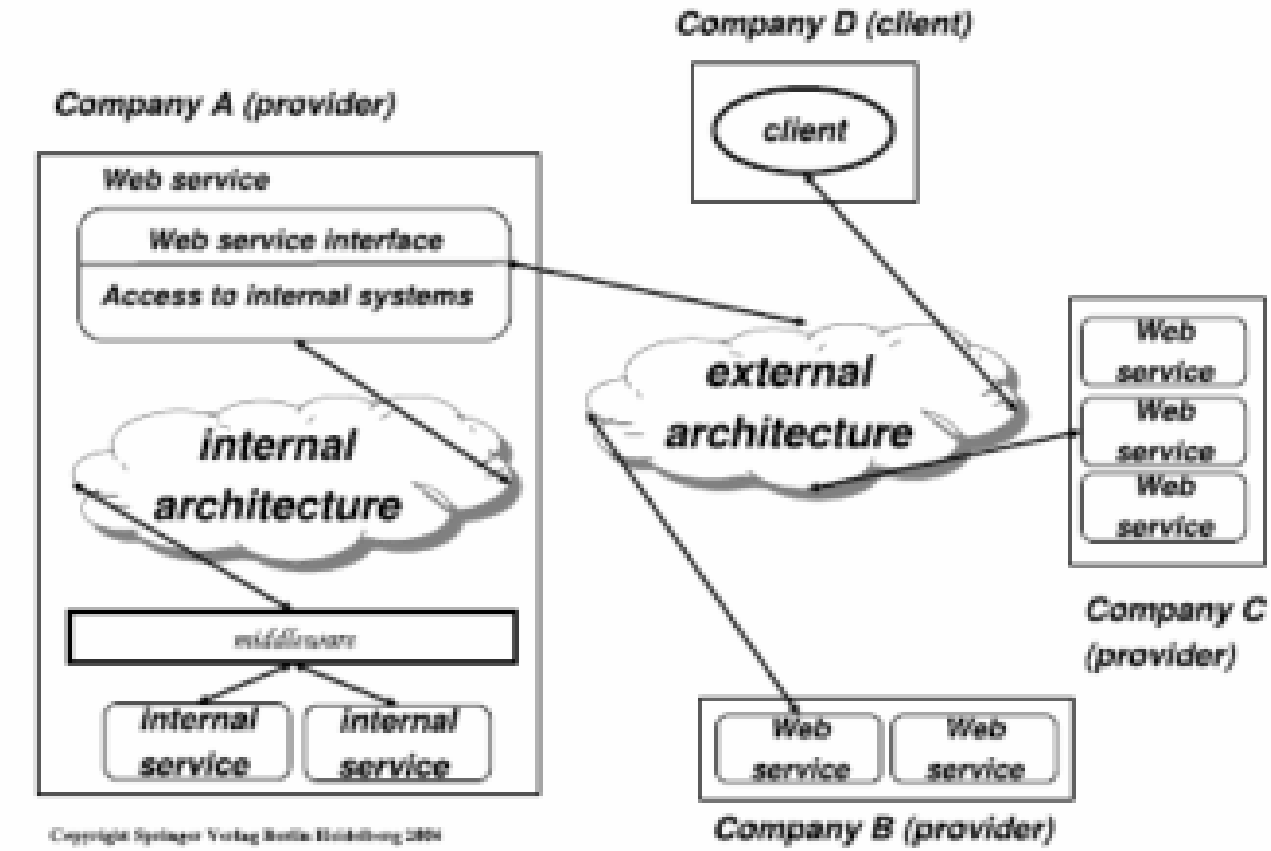


ETHERNET
Hand-shake, acknowledge, time-limit on response, network-status, fast –vs-



1.TCP/IP pkts
2. Web APIs

[I] Distributed Information Systems [32]



12/9/2018

External Architecture over Web Services and URLs

- W3C (web) 1. have external trackers, web search
- Transactions over Web Services 2. externalize logs/directories → Blockchain
- Polystore 3. externalize DBMS like architecture

Blockchain Networks

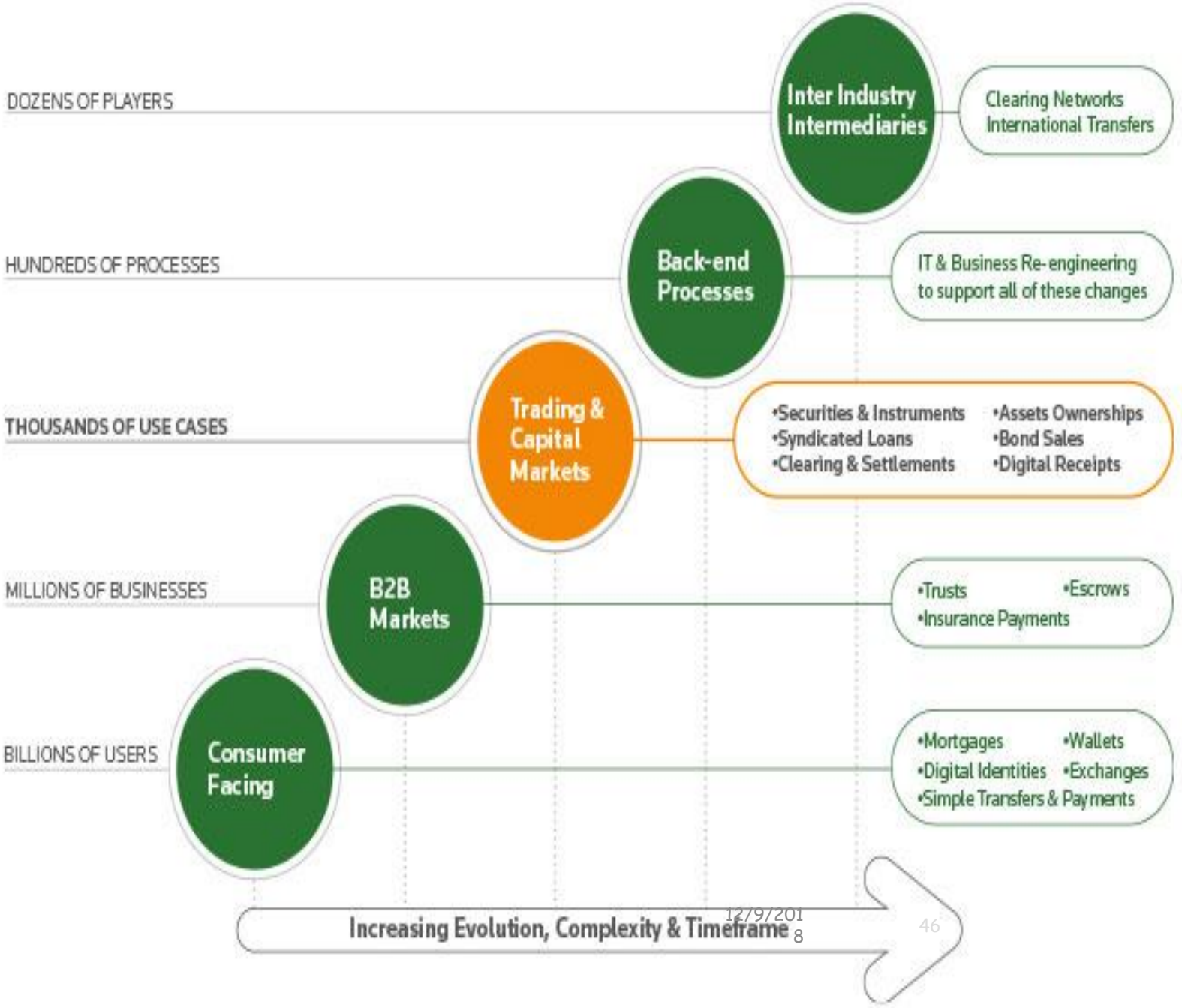
- Toyota to Bring Blockchain Networks to Smart Cars
- **IEEE Spectrum, May 2017,** By **Philip E. Ross**

- 1. It could make **car-to-cloud communication** easier and more secure, → if your car wants to talk to another car, a service provider network …
- **2. Blockchain Consensus**,
  Tyler Crain, Vincent Gramoli, Michel Raynal, Mikel Larrea. Proceedings of AlgoTel 2017.

Blockchain in use

- 1. Bay area in California
- Rent a Toyota car → 1. Down load an APP
- Smartphone Location → nearest car on Map
- Walk to the car– Select pay→ Car door unlocks

- 2. Driverless car / Remote Guidance System for Spacecraft


DOZENS OF PLAYERS
Inter Industry Intermediaries
Clearing Networks
International Transfers
HUNDREDS OF PROCESSES
Back-end Processes
IT & Business Re-engineering to support all of these changes
THOUSANDS OF USE CASES
Trading & Capital Markets
•Securities & Instruments
•Assets Ownerships
•Syndicated Loans
•Bond Sales
•Clearing & Settlements
•Digital Receipts
MILLIONS OF BUSINESSES
B2B Markets
•Trusts
•Escrows
•Insurance Payments
BILLIONS OF USERS
Consumer Facing
•Mortgages
•Wallets
•Digital Identities
•Exchanges
•Simple Transfers & Payments
Increasing Evolution, Complexity & Timeframe

A View of Web: Summary
Web Data Modeling

- Web Data
- Web Applications
- Web Services
- Cloud Computing
- Edge Computing
- Android – Apps
- APIs
- Google Map / Yahoo Maps / Microsoft Maps / Google Earth / Google Moon
- Astronomy Data – Shared world-wide among Astronomers for time-domain Astronomy
- Biological Sciences / Medline Plus / PubMed / Nature Data Stores