Service-Oriented Application Building
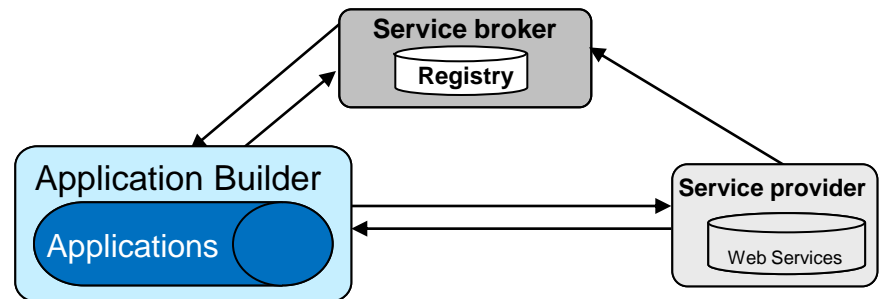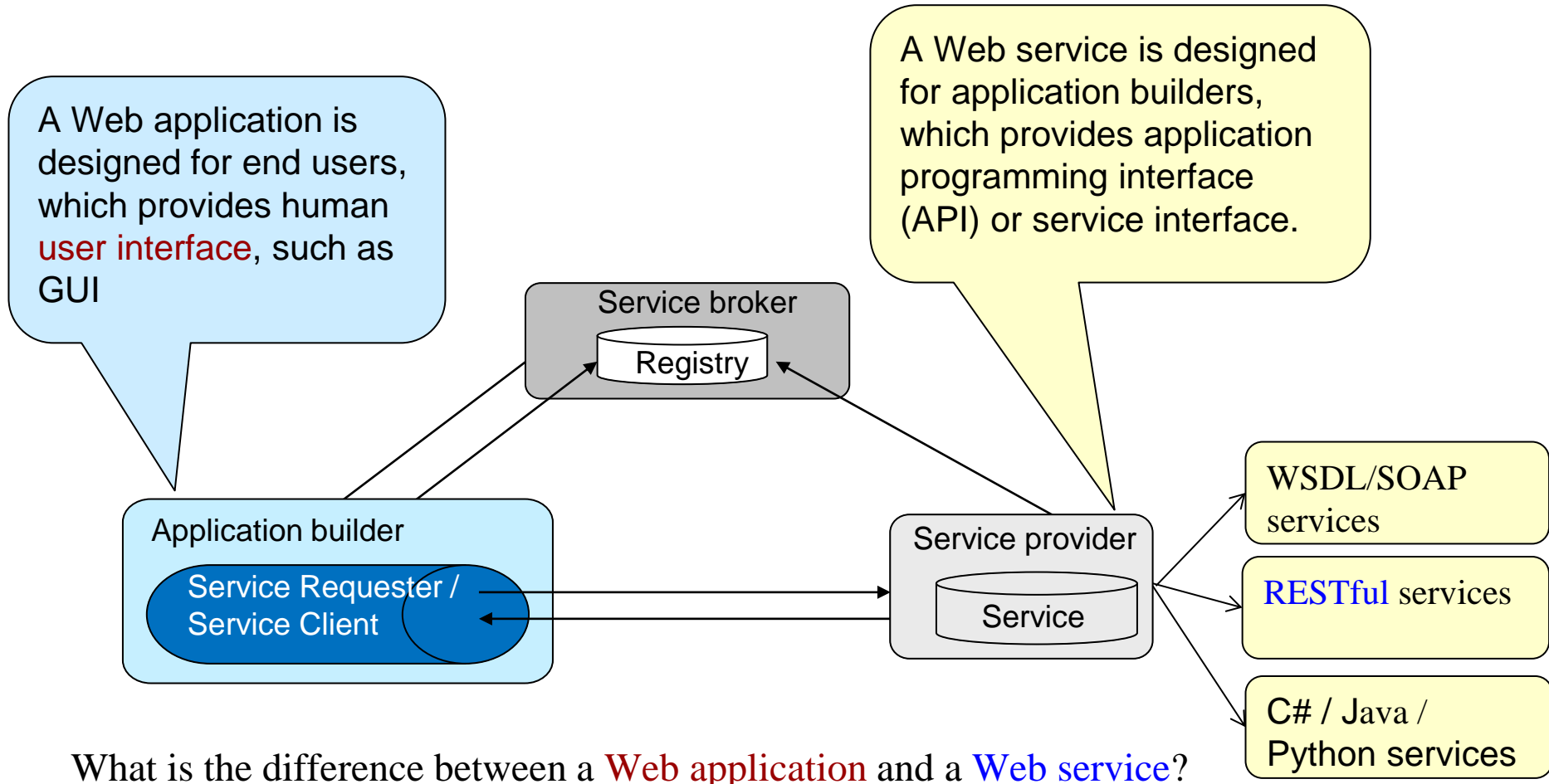
Overview and Roadmap

- Basic Concepts
- XML, SOAP, WSDL
- Web Services
- Service Registry and Repository
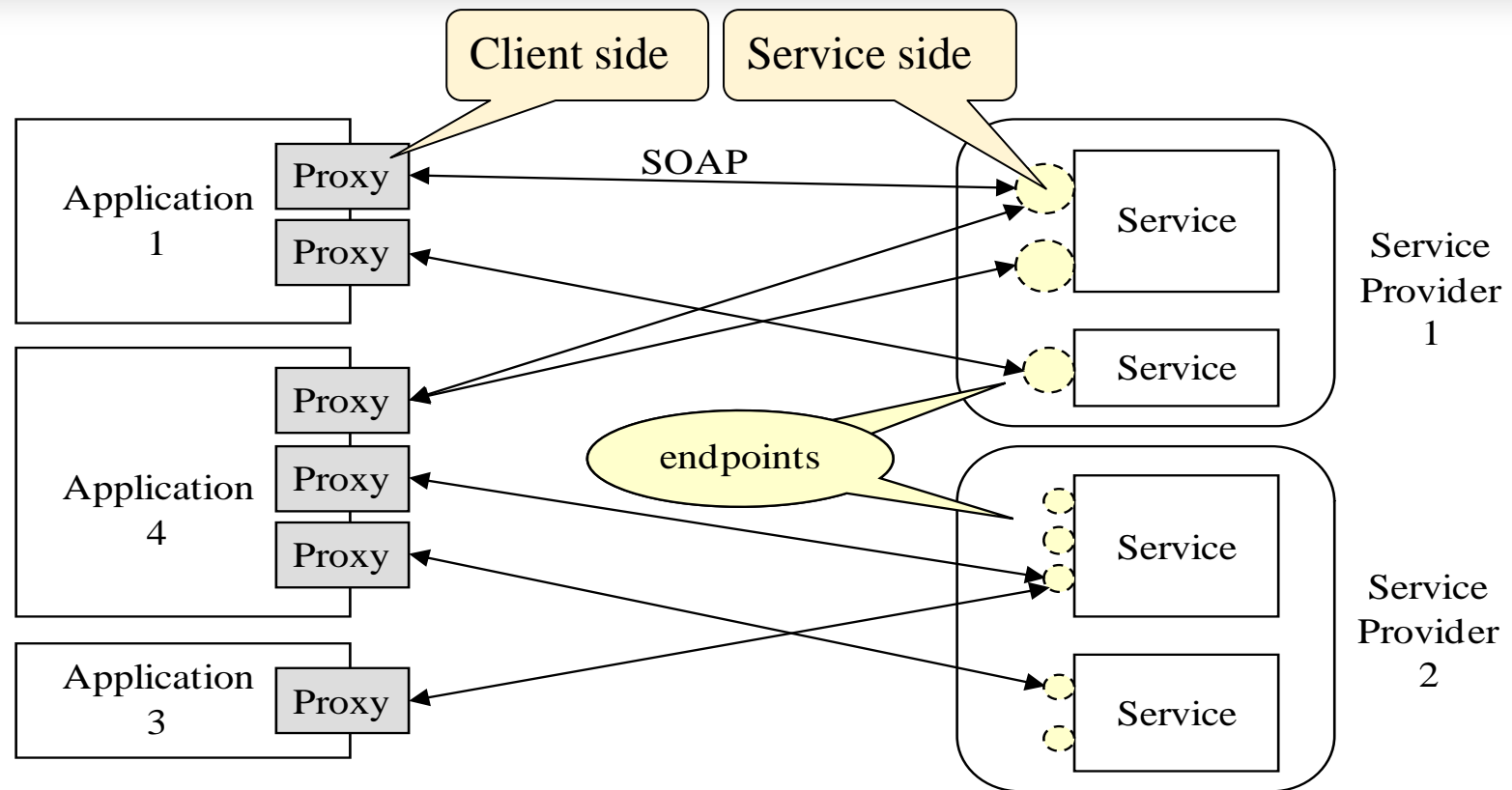- **Application Building**
- SOA Impact
- Myths and Facts

As an Application Builder

Develop Windows (Desktop) **Applications or**
Web Applications Using ASP .Net

A Web application is designed for end users, which provides human user interface, such as GUI

A Web service is designed for application builders, which provides application programming interface (API) or service interface.

Service broker

Registry

Application builder

Service Requester / Service Client

Service provider

Service

WSDL/SOAP services

RESTful services

C# / Java / Python services

What is the difference between a Web application and a Web service?
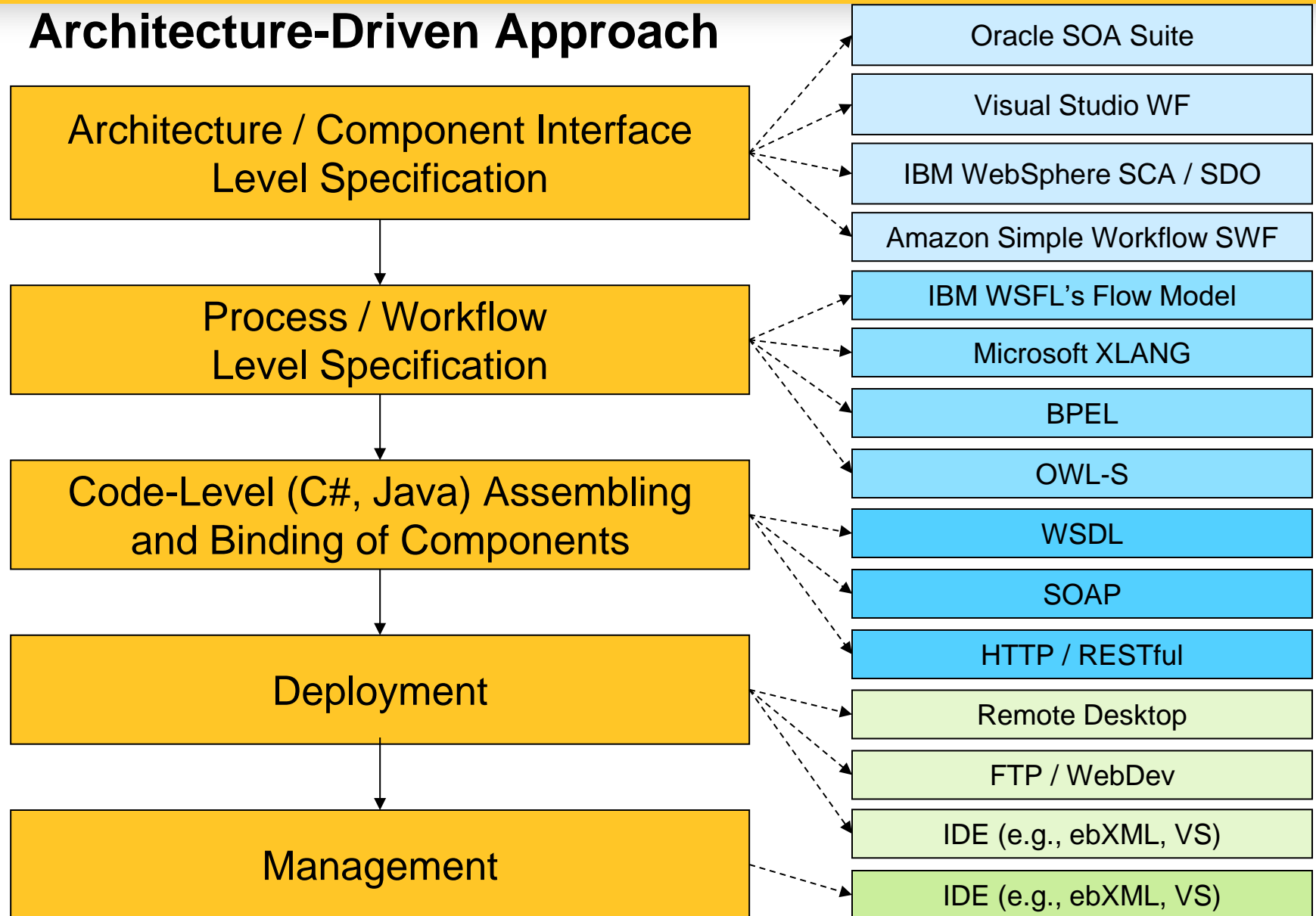
Applications Using WSDL Services Through Proxies

- A proxy in client is a "virtual" object that creates a channel to a (remote) service. A client accesses the operations of the services by calling the "methods" of the proxy. The "virtual" means here: It does not contain the implementation (code) of the methods.
- An endpoint in a (WSDL) service is an operation interface exposed to outside, so that a client can access the operation. It must include address, binding, and contract (operation name, parameter types, return type)

HTTPS Access to ASU Repository

- HTTPS: HTTP with SSL (Secure Sockets Layer)

- Starting from 2022, ASU requires all accesses to ASU servers to use HTTPS, instead of HTTP.

- When you develop a Web application to invoke WSDL web services in ASU Repository, you must use https.

- You can open the Web.config file of your Web application and change all http to https and http bindings to https bindings
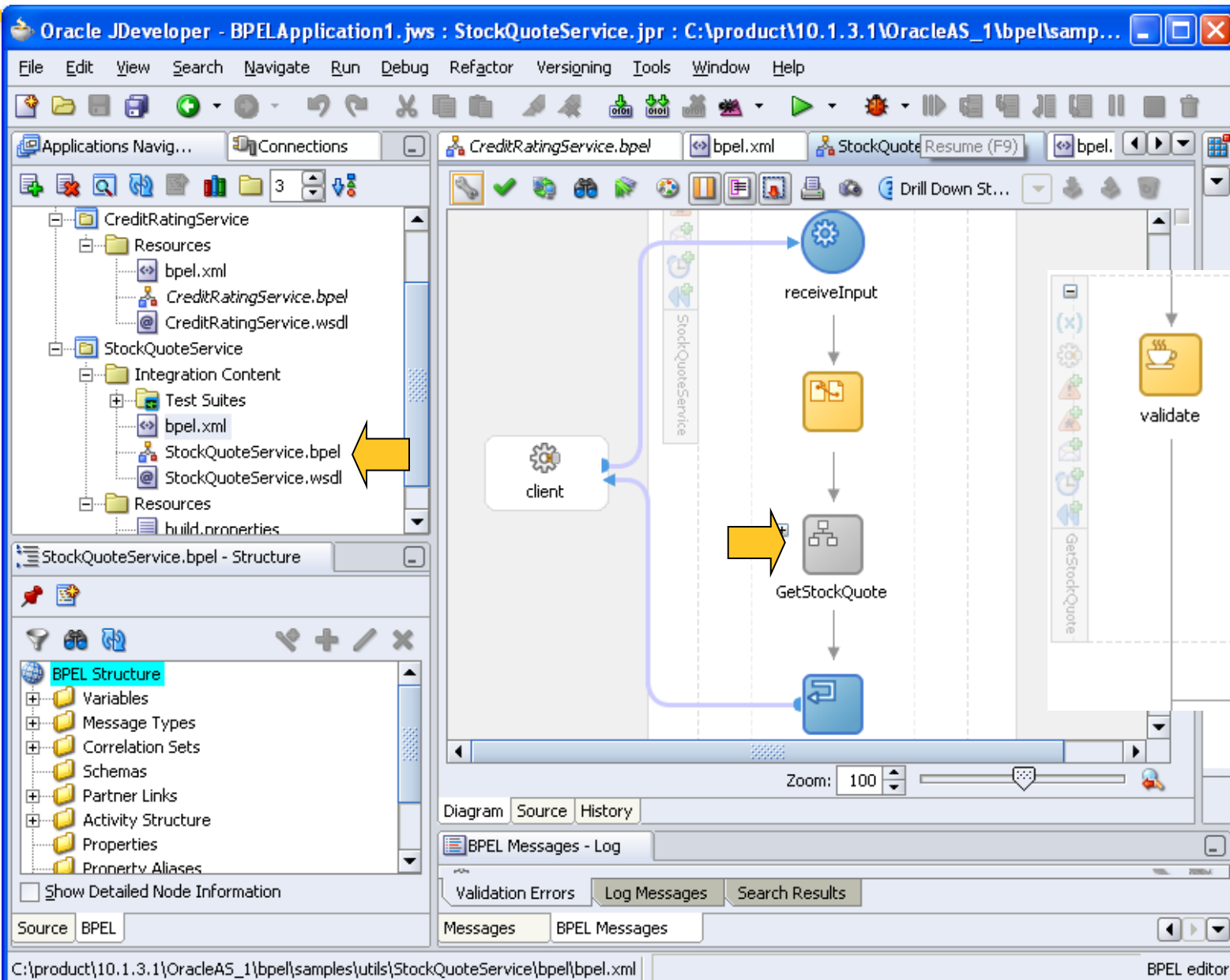
Process of Application Building in SOA Style

Architecture-Driven Approach

| Process Steps		Technologies
Architecture / Component Interface Level Specification		Oracle SOA Suite
		Visual Studio WF
		IBM WebSphere SCA / SDO
		Amazon Simple Workflow SWF
Process / Workflow Level Specification		IBM WSFL's Flow Model
		Microsoft XLANG
		BPEL
		OWL-S
Code-Level (C#, Java) Assembling and Binding of Components		WSDL
		SOAP
		HTTP / RESTful
Deployment		Remote Desktop
		FTP / WebDev
		IDE (e.g., ebXML, VS)
Management		IDE (e.g., ebXML, VS)

Oracle SOA Suite: StockQuoteService
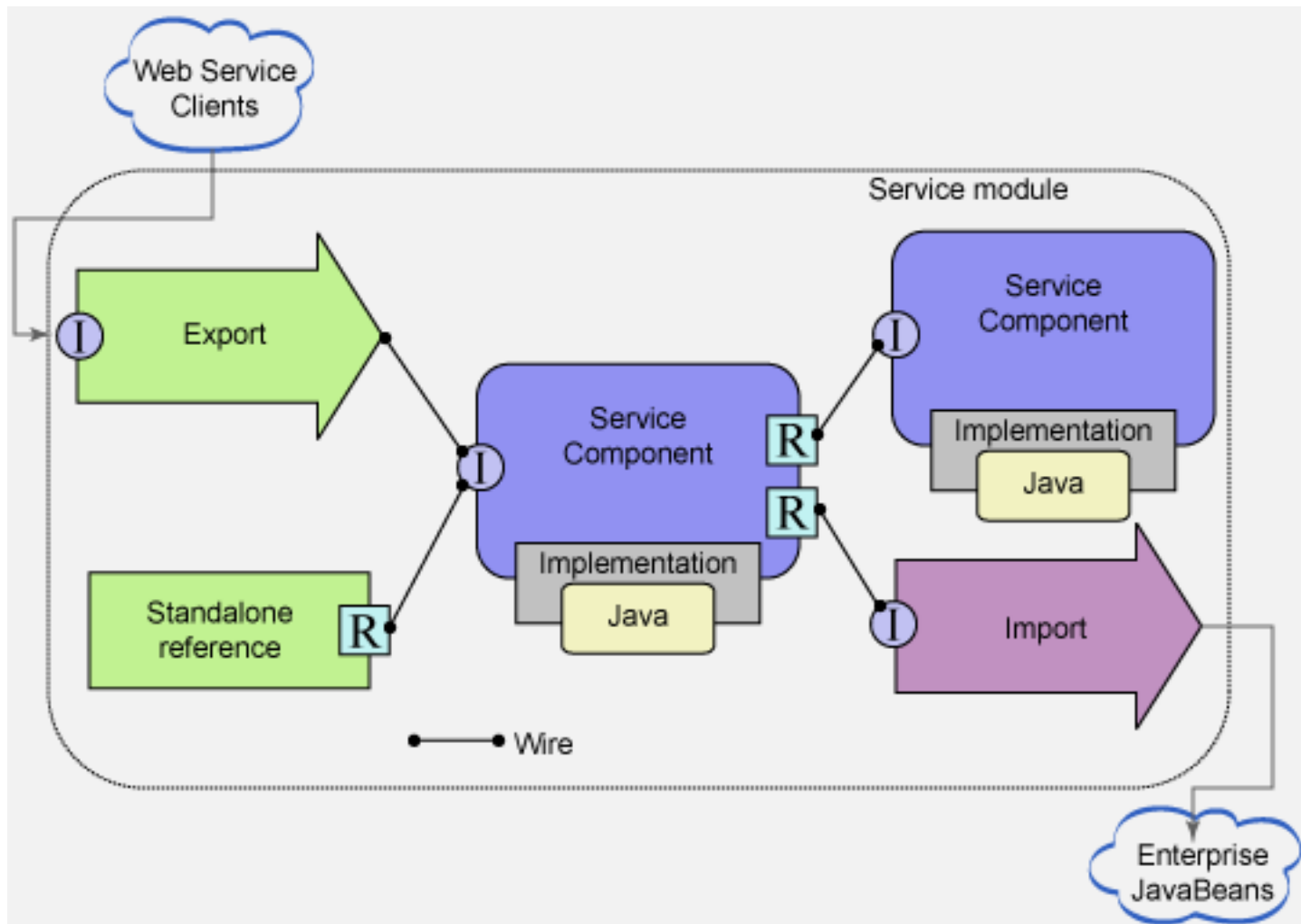

BPEL composition with WSDL interface

Microsoft Workflow Foundation
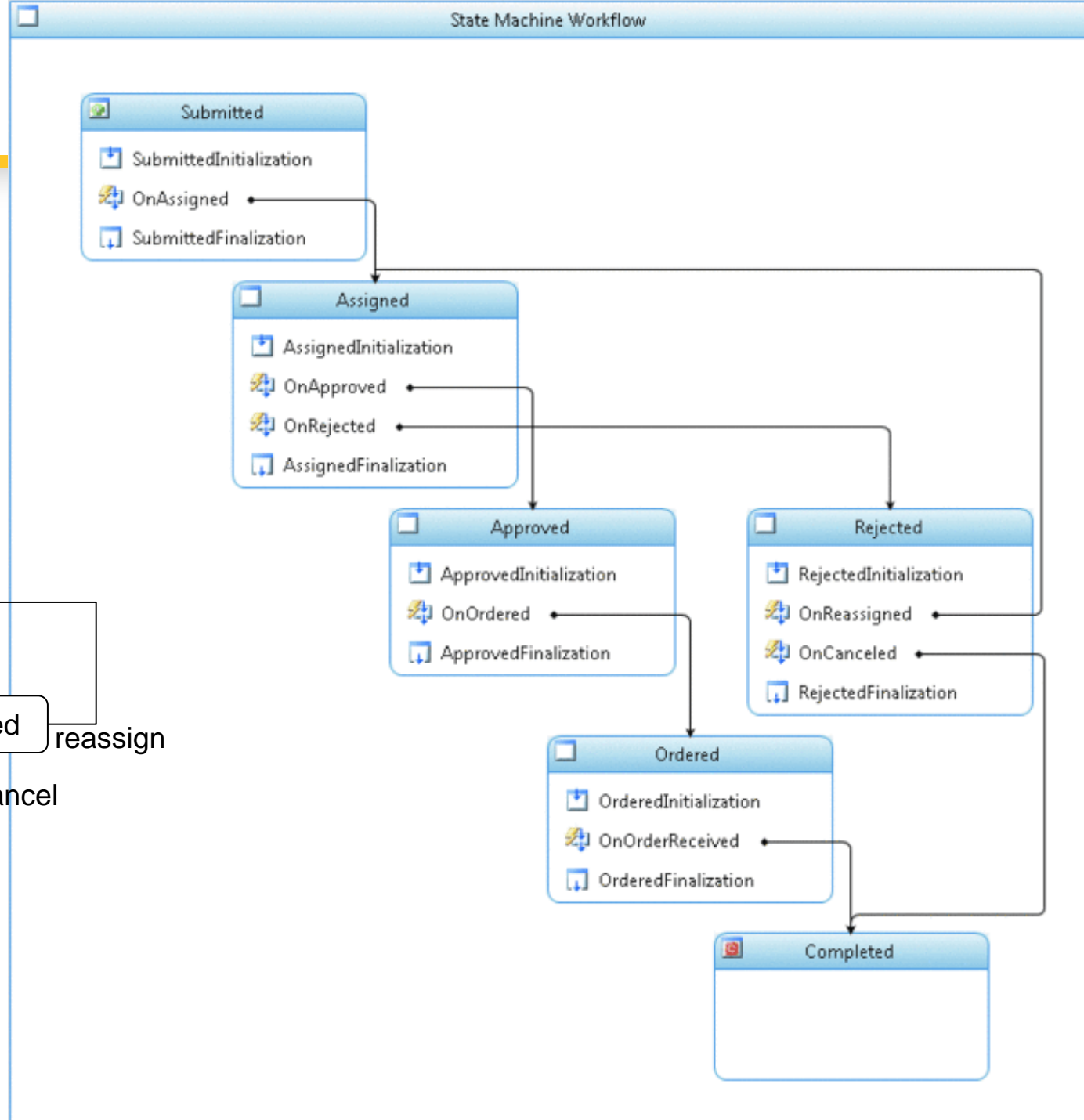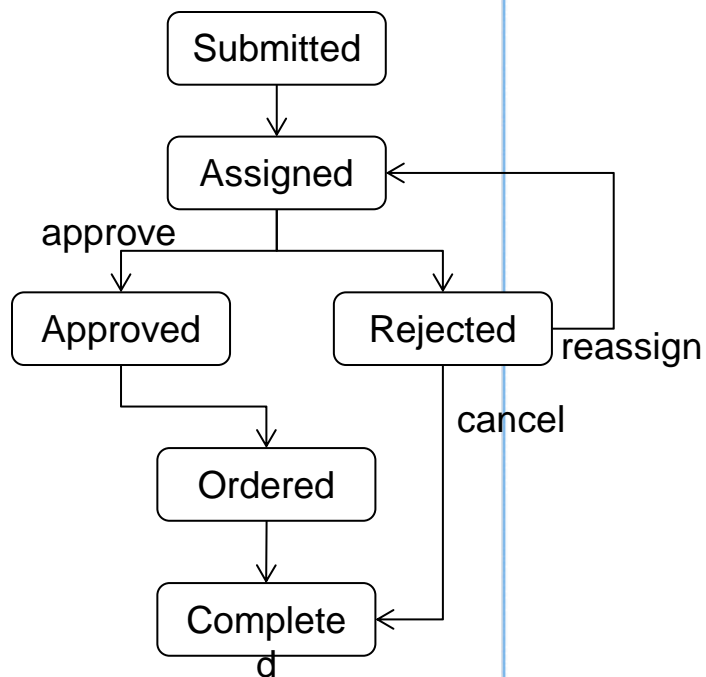
Service Component Architecture (SCA)

https://www.ibm.com/support/knowledgecenter/en/SSMKHH_10.0.0/com.ibm.etools.mft.doc/ac68550_.htm

Impact of SOA/SOC Paradigm

Explicit differentiation between software engineers and programmers (Three-Party Development Model)

- Application builders (**software engineers**) do not have to focus on programming in the small
- Programmers do not have to understand application domain

Tougher but equal competition

Shorter development cycle

Better and more reliable software from specialized providers

Different skill requirements:

- Fewer programmers-only jobs may be needed, as reuses increase, automated programming, etc.
- More software engineers (CS/CSE/SE graduates) will be needed, as applications increase.

Engineer Jobs (U.S. DoL Occupational Outlook Handbook 2010-2011)
http://www.bls.gov/ooh/

Occupational Title	Employment, 2008	Projected Employment, 2018	Change, 2008-18	
			Number	Percent
Engineers	1,571,900	1,750,300	178,300	11
Aerospace engineers	71,600	79,100	7,400	10
Agricultural engineers	2,700	3,000	300	12
Biomedical engineers	16,000	27,600	11,600	72
Chemical engineers	31,700	31,000	-600	-2
Civil engineers	278,400	345,900	67,600	24
Computer hardware engineers	74,700	77,500	2,800	4
Electrical and electronics engineers	301,500	304,600	3,100	1
Electrical engineers	157,800	160,500	2,700	2
Electronics engineers, except computer	143,700	144,100	400	0
Environmental engineers	54,300	70,900	16,600	31
Industrial engineers, including health and safety	240,400	273,700	33,200	14
Health and safety engineers, except mining safety engineers and inspectors	25,700	28,300	2,600	10
Industrial engineers	214,800	245,300	30,600	14
Marine engineers and naval architects	8,500	9,000	500	6
Materials engineers	24,400	26,600	2,300	9
Mechanical engineers	238,700	253,100	14,400	6
Mining and geological engineers, including mining safety engineers	7,100	8,200	1,100	15
Nuclear engineers	16,900	18,800	1,900	11
All Engineers	**1,571,900**	**1,750.300**		**11**

Software Engineers and Computing Related Occupations

U.S. DoL Occupational Outlook Handbook 2010-2011 http://www.bls.gov/ooh/

All Engineers	1,571,900	1,750.300		11

Occupational title	Employment in 2008	Employment in 2018	Change in number	Change in percentage
Computer software engineers	909,600	1,204,800	295,200	32
Computer systems analysts	532,200	640,300	108,100	20
Computer network, systems, and database administrators	961,200	1,247,800	286,600	30
Computer programmers	426,700	414,400	-12,300	-3
Computer support specialists	565,700	643,700	78,000	14
Computer and information systems managers	293,000	342,500	49,500	17
	2,7788	3,2887		

Rank	Job Title	Median Salary	2011 Job number	10 year growth rate	2021 Job number
1	Biomedical Engineer	$79,500	15,700	61.7%	25,387
2	Marketing Consultant	$92,100	282,700	41.2%	399,172
3	**Software Architect**	**$119,000**	**3,426,000**	**24.6%**	**4,268,796**
4	Clinical Research Associate	$90,700	100,000	36.4%	136,400
5	**Database Administrator**	**$87,200**	**110,800**	**30.6%**	**144,705**
6	Financial Adviser	$90,200	206,800	32.1%	273,183
7	Market Research Analyst	$63,100	282,700	41.2%	399,172
8	Physical Therapist	$76,700	198,600	39.0%	276,054
9	**Software Developer**	**$84,200**	**3,426,000**	**24.6%**	**4,268,796**
10	Occupational Therapist	$74,900	108,800	33.5%	145,248
11	Management Consultant	$110,000	718,800	21.9%	876,217
12	Optometrist	$105,000	34,200	33.1%	455,20
13	**IT Consultant**	**$96,400**	**544,400**	**22.1%**	**664,712**
14	**IT Network Engineer**	**$73,400**	**347,200**	**27.8%**	**443,722**
15	**IT Security Consultant**	**$102,000**	**347,200**	**27.8%**	**443,722**

100 Best Jobs US News 2021

https://money.usnews.com/careers/best-jobs/rankings/the-100-best-jobs

Job Title	Job #	Median Salary	Degree needed
1. Physician Assistant	39,300	112,260	Master's
2. Software Developer	316,000	107,510	Bachelor's
3. Nurse Practitioner	110,700	109,820	Master's
4. Medical and Health Services Manager	133,200	100,980	Bachelor's
5. Physician	18,500	206,500	Doctorate
6. Statistician	14,800	91,160	Master's
7. Speech-Language Pathologist	40,500	79,120	Master's
8. Data Scientist	10,300	94,280	Bachelor's
9. Dentist	3,700	155,600	Doctorate
10. Veterinarian	14,200	95,460	Doctorate
11. Orthodontist	200	208,000	Doctorate
12. IT Manager	48,100	146,360	Bachelor's
Summary: Medical related jobs	**280,500**		**Master/Doctor**
Summary: Computing related jobs	**389,200**	**x 1.39**	**Bachelor**

100 Best Jobs US News 2023

https://money.usnews.com/careers/best-jobs/rankings/the-100-best-jobs

Job Title	Job #	Median Salary	Degree needed
1. Software Developer	370,600	120,730	Bachelor's
2. Nurse Practitioner	112,700	120,680	Master's
3. Medical and Health Services Manager	136,200	101,240	Bachelor's
4. Physician Assistant	38,400	121,530	Master's
5. Information Security Analyst	56,500	102,600	Bachelor's
6. Physical Therapist	40,400	95,620	Doctorate
7. Financial Manager	123,100	131,710	Bachelor's
8. IT Manager	82,400	159,010	Bachelor's
9. Web Developer	28,900	77,030	Bachelor's
10. Dentist	7,700	160,370	Doctorate
11. Lawyer	80,200	127,990	Doctorate
12. Veterinarian	16,800	100,270	Doctorate
Summary: Medical related jobs	352200		Master/Doctor
Summary: Computing related jobs	538400	x 1.53	Bachelor

25 Best Jobs US News **2024**

Job Title	Median Salary	New Job #	Job growth %
1. Nurse Practitioner	$121,610	118,600	45.5%
2. Financial Manager	$139,790	126,600	16%
3. Software Developer	$127,260	410,400	25.7%
4. IT Manager	$164,070	85,900	15.4%
5. Physician Assistant	$126,010	39,300	26.6%
6. Medical and Health Services Manager	$104,830	144,700	28.4%
7. Information Security Analyst	$112,000	53,300	31.6%
8. Data Scientist	$103,500	59,300	35.1%
9. Actuary	$113,990	6,900	23%
10. Speech-Language Pathologist	$84,140	33,100	19.3%
11. Marketing Manager	$140,040	23,700	6.6%
12. Statistician	$98,920	10,600	31.8%
Summary: Medical related jobs	**$105,074**	**335,700**	
Summary: Computing related jobs	**$121,150**	**619,500**	**x 1.85**

Myths and Facts of SOA (2015)

Myth	Fact
SOA is a technology.	SOA is a design philosophy independent of any product, technology, or industry trend.
SOAs require Web Services.	SOAs can be realized using Web services, but using Web services will not necessarily result in a SOA.
SOA is new and revolutionary.	EDI (Electronic Data Interchange), CORBA, and DCOM were conceptual examples of SOA.
SOA ensures the alignment of IT and business.	SOA is not a methodology.
A SOA Reference Architecture reduces implementation risk.	SOAs are like snowflakes: No two are the same.
SOA requires a complete technology and business-processes overhaul.	SOA should be incremental and built on your current investments.
SOA requires an army of consultants.	SOA requires tools, not consultants.
We need to build a SOA.	SOA is a means, not an end.

Seven Fallacies of SOA

1. There's Nothing New Under the Sun, and SOA Is No Exception;

2. SOA is a Revolutionary Paradigm Shift;

3. SOAs are All Hype, No Substance;

4. SOA is a Panacea;

5. The Overhead from SOA Leads to Unacceptably Poor Performance;

6. A Bottom-Up Approach to SOA is Good Enough;

7. SOA is Optional.

How Does SOA Address the DC Fallacies?

1. **The network is reliable.**

2. **Latency is zero.**

3. **Bandwidth is infinite.**

4. **The network is secure.**

5. **Topology doesn't change.**

6. **There is one administrator.**

7. **Transport cost is zero.**

8. **The network is homogeneous**

Will be discussed in a later module

Race between communication and computing: who wins?

Latency and bandwidth, which one is harder to resolve?

Will be discussed in a later module

SOA uses end-to-end communication

Orchestration (central controlled) versus Choreography (distributed)

This is one of the costs of distribution

SOA is platform independent!