

Opening Panel: The Next Generation of Services and Agenda for Finance, Economic, Management and IT Business

Dr Muthu Ramachandran PhD FBCS Fellow of Advance HE, MIEEE, MACM
Principal Lecturer
Software Engineering Technologies and Emerging Practices (SETEP) Research Group
Lead
School of Computing, Creative Technologies, and Engineering (CCTE)
Leeds Beckett University
Email: M.Ramachandran@leedsbeckett.ac.uk

Application of Business Process Modelling and Blockchain Technologies for Financial Cloud

Dr Muthu Ramachandran PhD FBCS Fellow of Advance HE, MIEEE, MACM

Principal Lecturer

Software Engineering Technologies and Emerging Practices (SETEP) Research Group
Lead

School of Computing, Creative Technologies, and Engineering (CCTE)

Leeds Beckett University

Email: M.Ramachandran@leedsbeckett.ac.uk

Main Theme

- Digital economy, digital currencies, and advancement in information technology have contributed to tremendous growth in the global economy and financialisation.
- In order to have contributed sustain this growth, a systematic approach is necessary for all aspects of the financial process and applications.
- To a certain extent, it has also created problems in social and economic instability. In order to minimize damaging impacts caused by the lack of regulatory compliance, governance, ethical responsibilities and trust, we have been applying rigorous business requirements analysis framework known as Business Integrity Modelling and Analysis (BIMA) and detailed Business Process Modelling and Simulation (BPMN) techniques to unify business integrity with business performance using by intelligent big data predictive analytics and business intelligence.
- This talk will provide an application of BPMN for financial application as a Service and will also provide an overview of blockchain technology adoption for the financial cloud.
- Blockchain Technology (Gary Wills, University of Southampton)

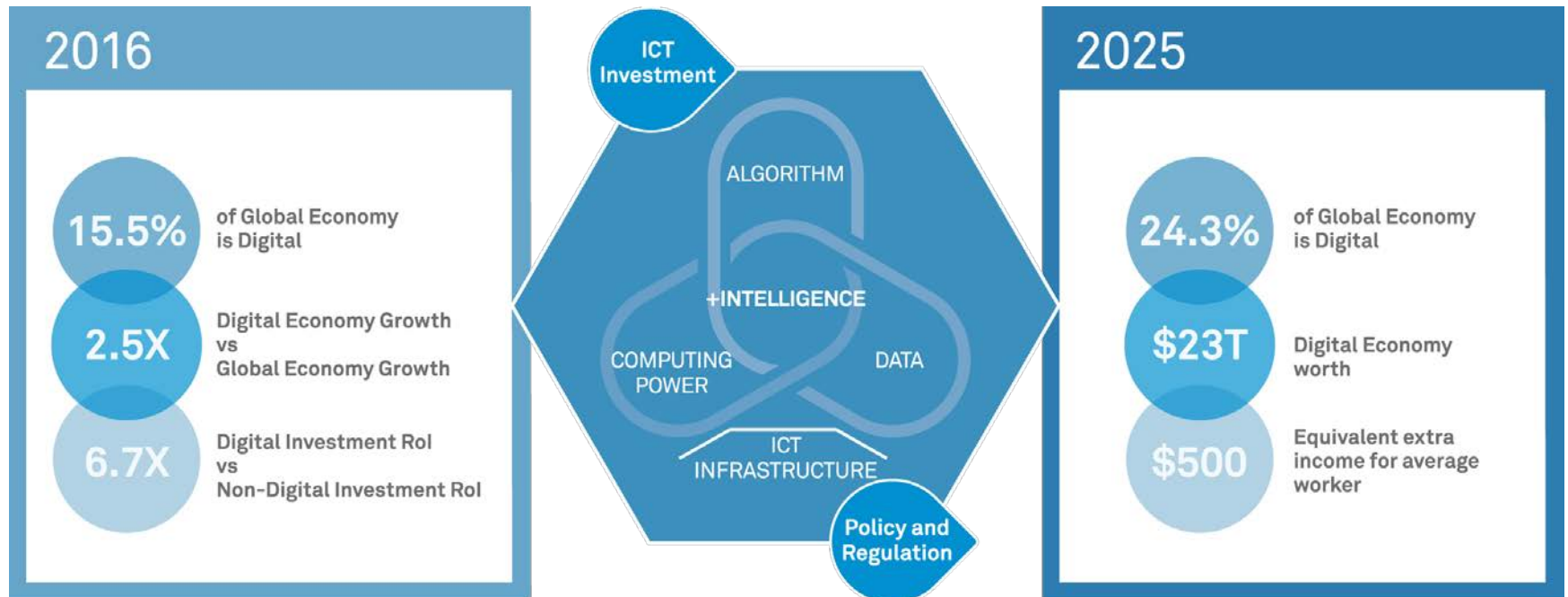
In this talk...

- Digital Economy and Knowledge Capital (Information Age)
- Business Case for this talk (Motivation and Research Statement)
- Why BPM (Business Process Management = BPMN+CMMN+DMN) for Financial Services and Financial Cloud Based Applications?
- Business Integrity Modelling and Analysis (BIMA)
- BIMA, BPMN, Domain Modelling, and SOA Driven Approaches to Financial Cloud (FC) Based Applications
- Predictive Modelling & Technologies for FC: AI, ML, Smart Devices, IoTs, Cloud, Blockchain Technologies
- Blockchain Technology (Gary Wills, University of Southampton)
- Conclusion and Questions



DIGITAL ECONOMY, KNOWLEDGE CAPITAL, ICT BUSINESSES & GROWTH PREDICTIONS

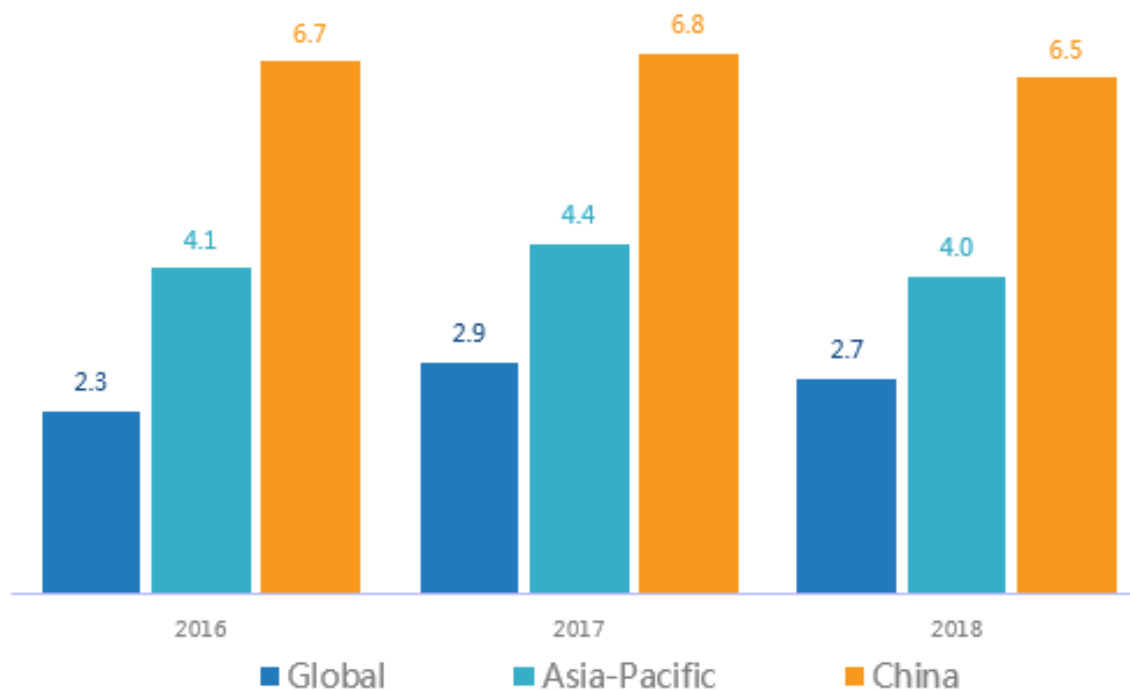
Value of Digital Economy



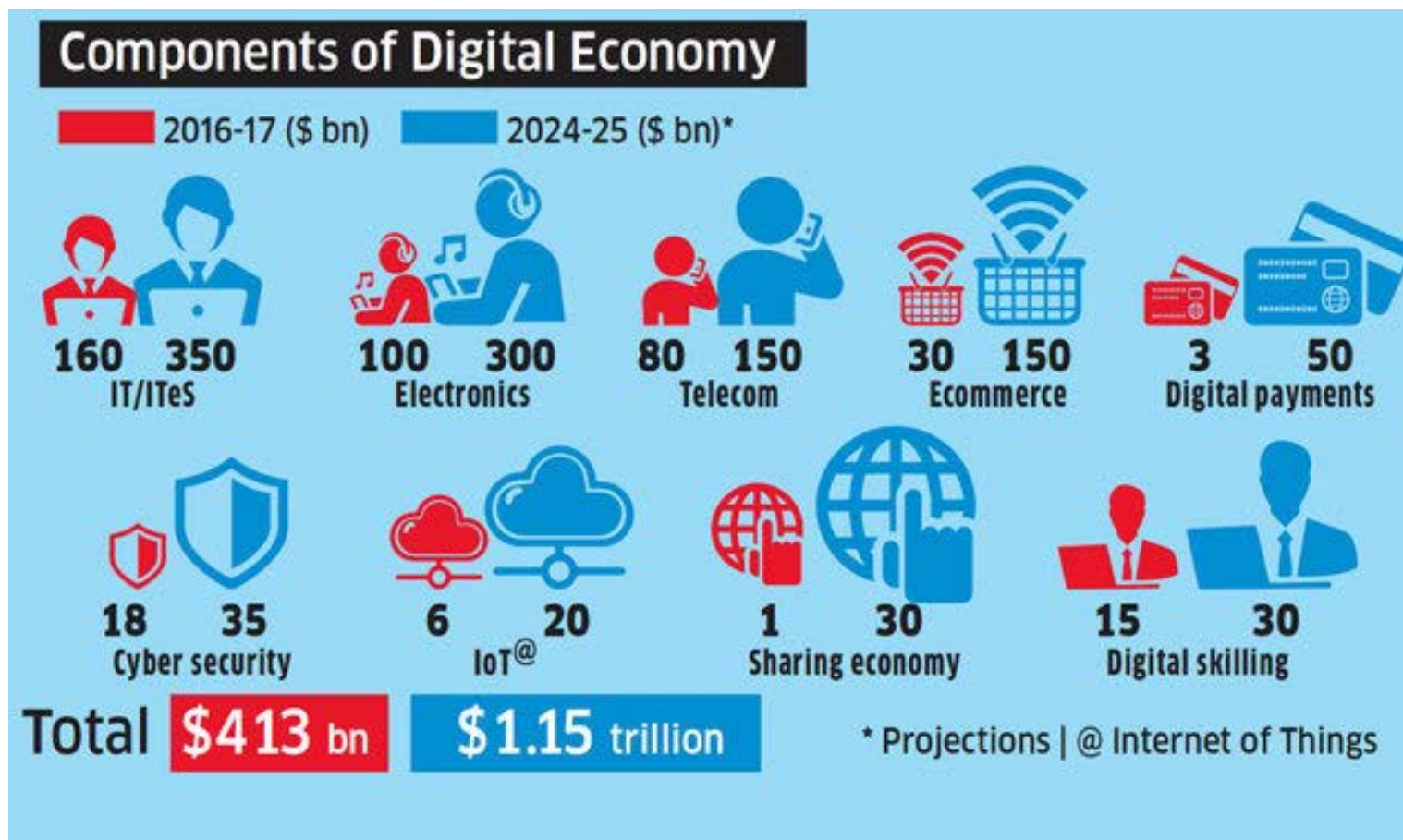
Digital Economy Impacts on GDP Growth



GDP growth in 2016-2018 (%)

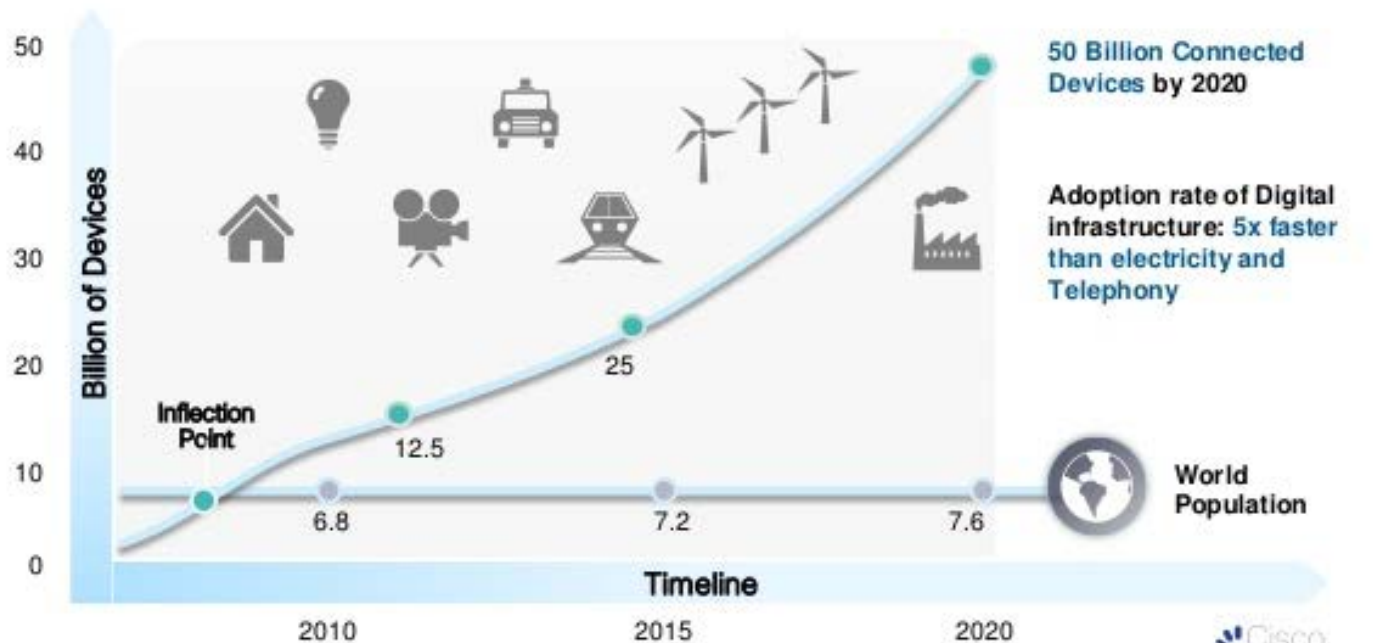


Components of Digital Economy



Connected Devices

Present: Internet of Things

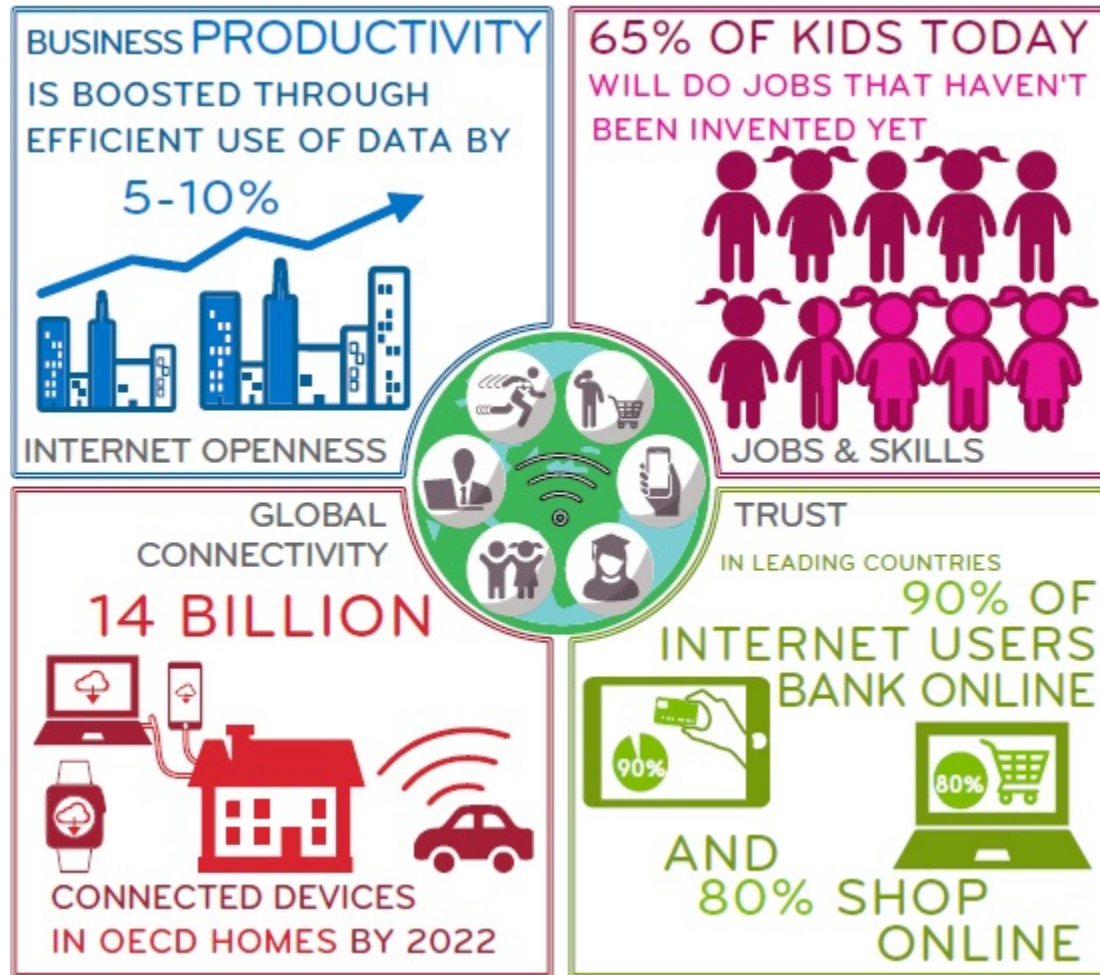


Source: Cisco Internet of Things Report; Cisco Consulting Analysis

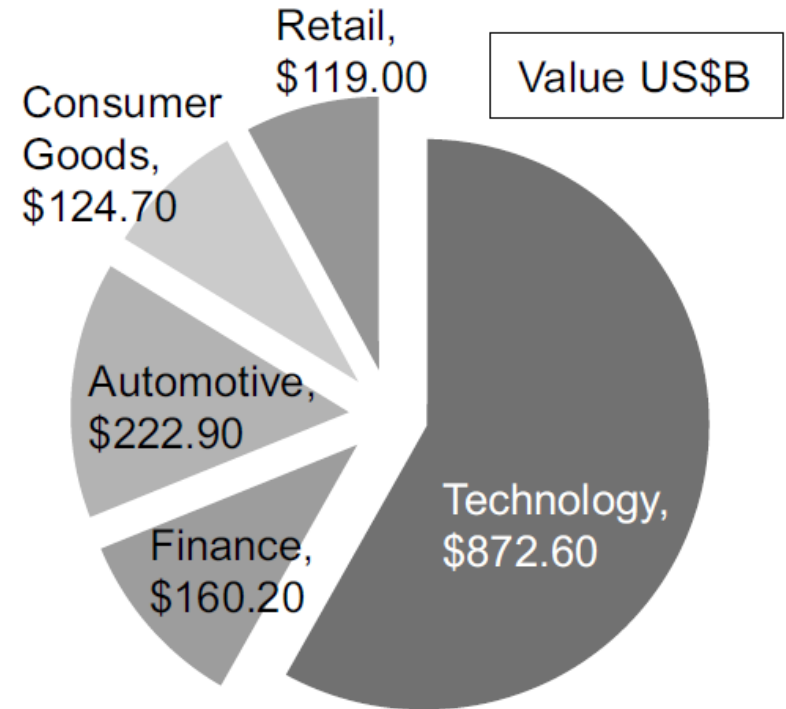
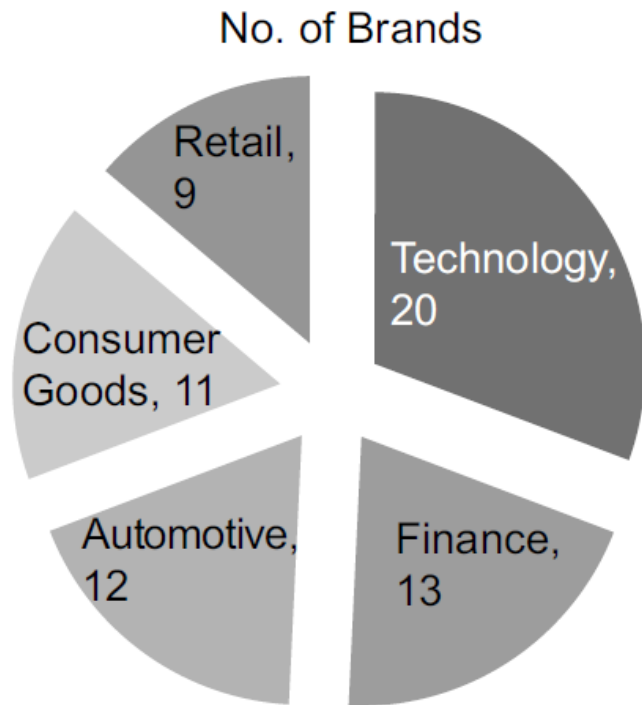
© 2015 Cisco and/or its affiliates. All rights reserved.



Business and knowledge Capital



Forbes (2018) 100 Most Valuable Brands List



The most recent report also shows that the number of technology brands (20%) and their value (US\$872.6 billion, 40%) are much greater than other industries (see Figure 1.1). **The value of the financial services industry is only US\$160.2 billion with thirteen brands.** This difference of number and value of brands in the tech and financial industries is due to the difference in strategy toward innovation and digitalization.



BUSINESS CASE FOR THIS TALK: FINTECH

Fintech: Ant Financial Services, China (Business Case for this talk...)

Figure 1. Ci Ren Ge Dan uses Ant Financial's services to receive and make payments for the tent store he operates at the foot of Mount Everest, 5,200 meters above sea level.



Figure 2. Zhang Yousheng, a herdsman, uses Ant Financial microloans to purchase calves and fodder.



Digital revolution vs. Challenges for Financial Service Sectors: Fintech Claims

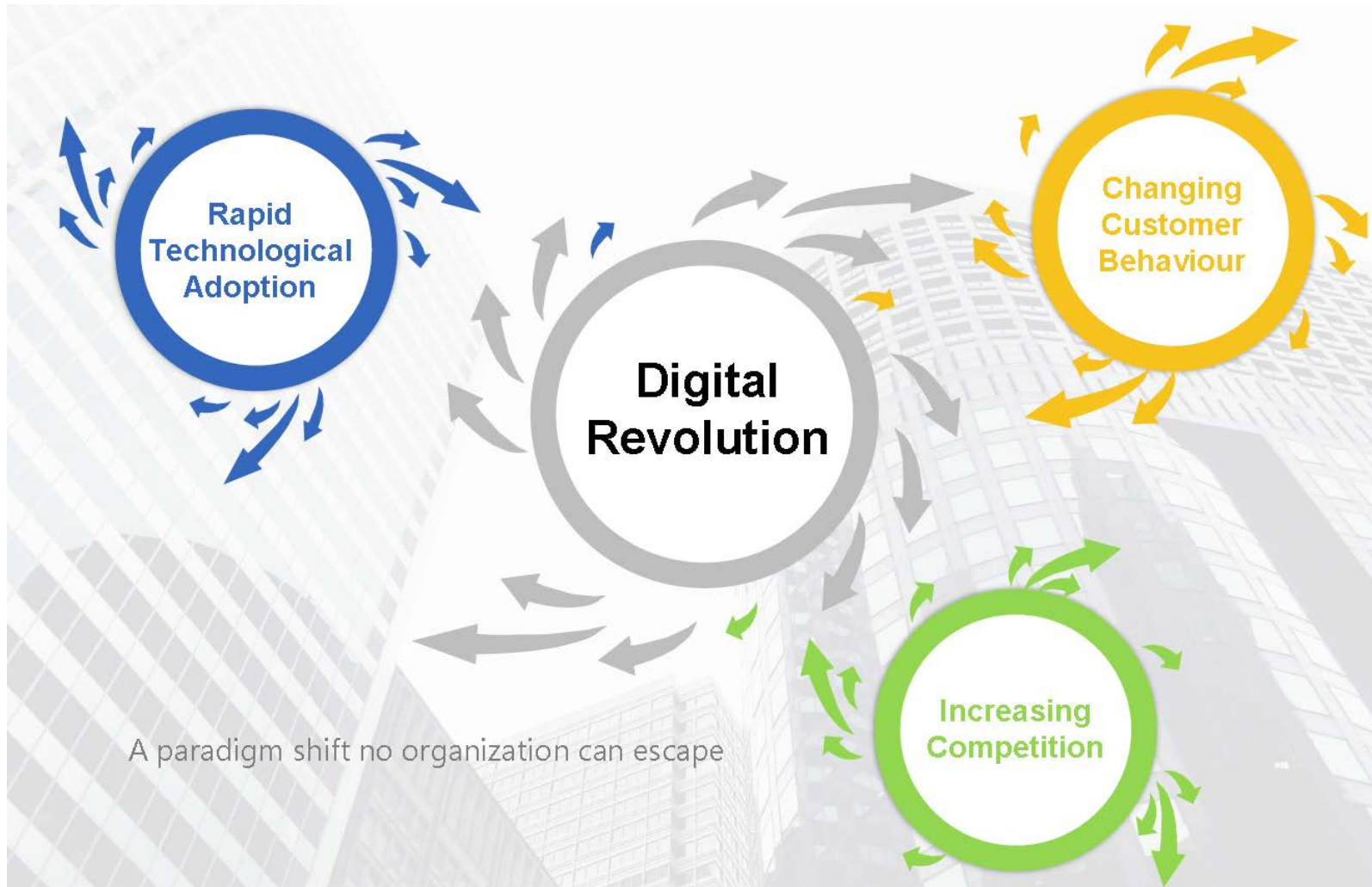
- FINANCIAL TECHNOLOGY, ALSO known as fintech, is a fast-evolving field that has reshaped the financial industry.
- Financial service providers face **major challenges** when digitizing service for the future economy: Customers and Businesses vs. Low-cost vs. Fast vs. Risks vs. Trust vs. Intelligent Way of providing business services
- Ant Financial focuses on five technologies: Blockchain, AI, Security, IoT, and Computing (BASIC) or also known as AI, Blockchain, Cloud, Data Analytics (ABCD)
- Ant Financial has redefined digital financial services, specifically mobile payment and microloan services, and Ping An Technology has developed.
- The innovation of QR payment builds a point-of-sale transaction (offline payment) for remote villages in the foot steps of mount Everest. Decisions made instantly for microloans and car accidental damages with customer sent photos

Main Finding of Fintech

- Their main findings

- Blockchain provides a new trust mechanism to transactions
- Deep learning and natural language processing technologies helped intelligent customer service robots achieve higher customer satisfaction rates than live service staffs
- AI Assessment of Claims and Risks for Insurance and Loans Sectors

Changing world, changing business and technology



Therefore, it is essential to design and implement well proven business processes which is customer driven

Why SOA? Service Computing of Everything: Internet of Everything (IoE) for the Future of Business IT

The Future is here!

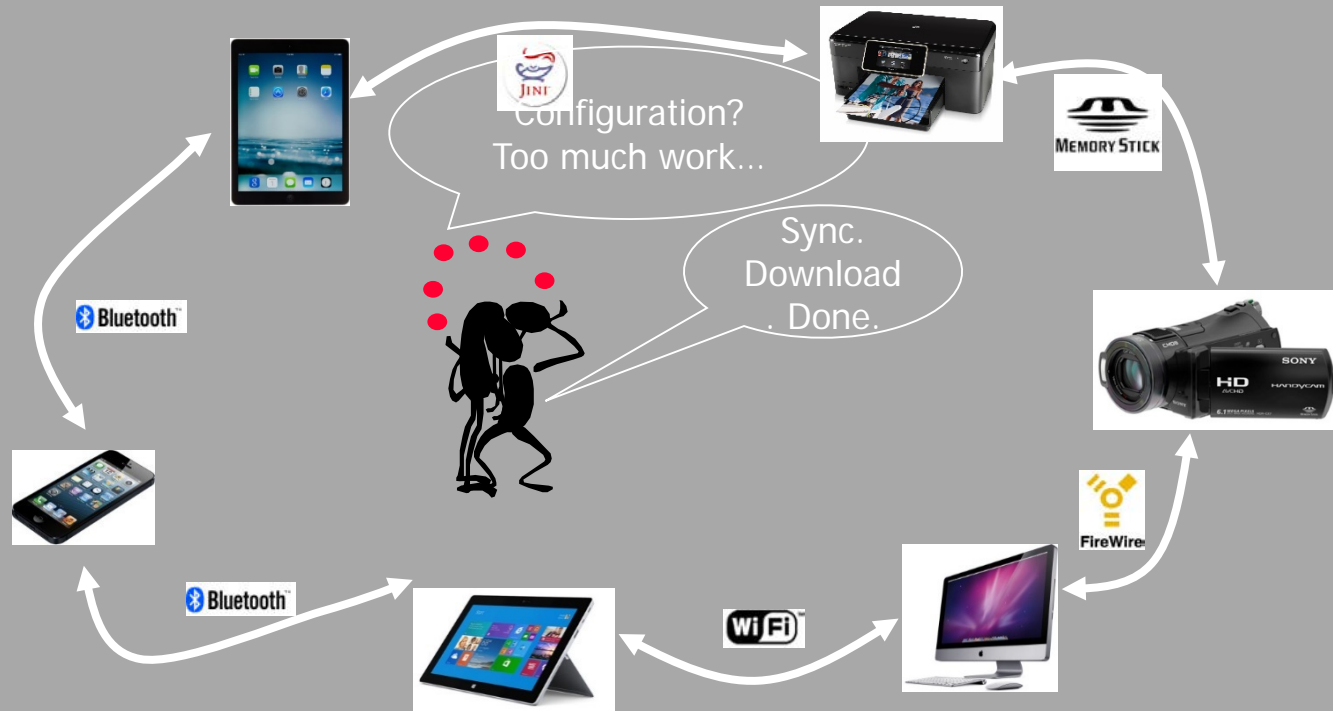
Why SOA? Multitude of devices, seamless data, intelligence, multitude of software, systems, services, and platform integration, and predictions. The Future is here!

SOA is a formalised way of integrating applications existing (traditional applications and legacy systems) into an enterprise architecture and hence suitability for connecting IoEs

YESTERDAY: GADGETS ARE EVERYTHING

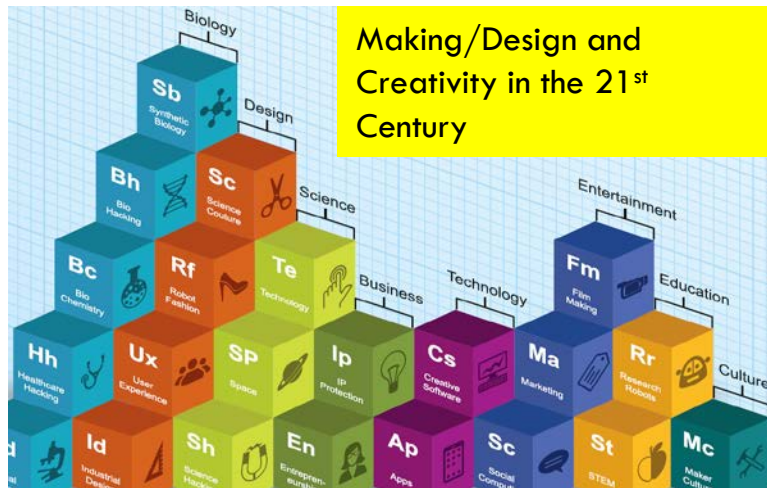


TODAY: COMMUNICATION IS EVERYTHING



Tomorrow: Service is Everything: they communicate, compose new services, and self recover themselves

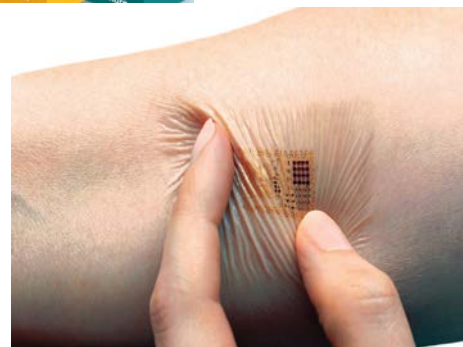




Making/Design and Creativity in the 21st Century



3D-printed “science” necklace: Making in the 21st Century, Computer Dec 2014

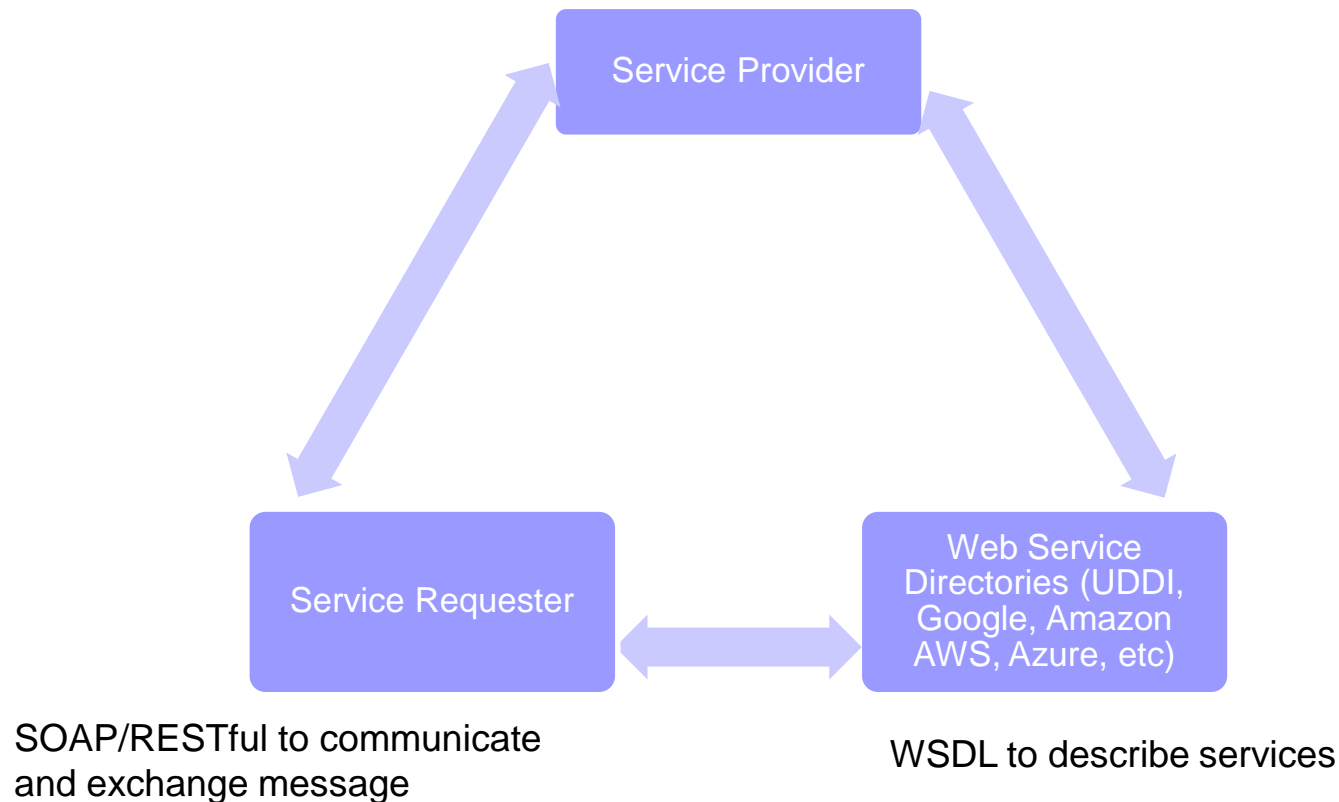


MC10's Biostamp: wireless health reading data



A Robot Penguin chick to monitor others (IoT)

Service-Driven IT is the Future: SOA Paradigm

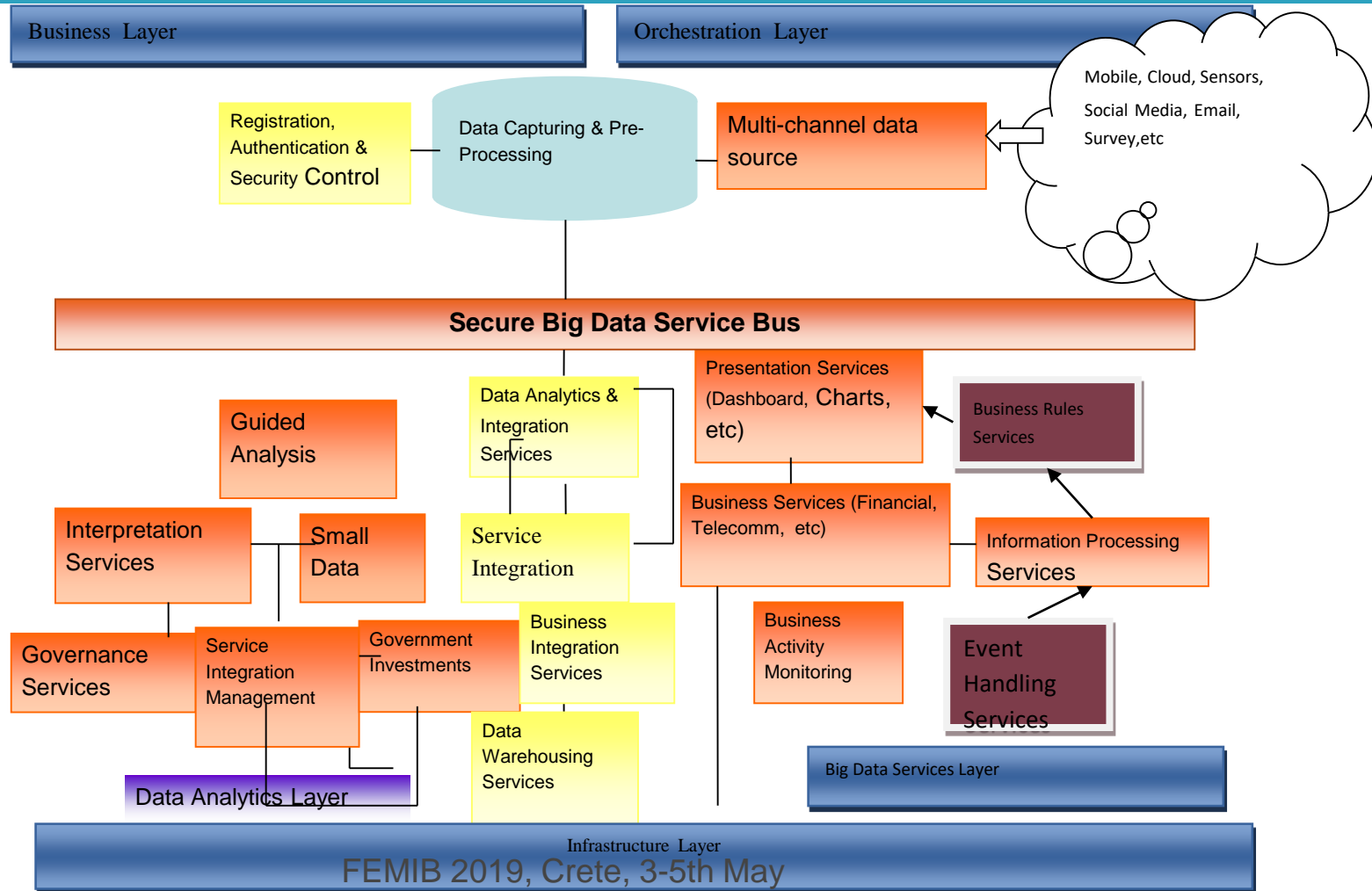


The main focus and purpose is customer driven methods, processes (applicable to both traditional as well as Agile based), and technologies

Example SOA Design: Muthu SOA Architecture for Big Data Applications

(Ramachandran 2017, CRC Book Chapter)

23



Business Process Driven Approach to Service and Cloud Computing (BPD4SCC): Our Model

Service Requirements with BPMN

- Initial process models: Actors/roles/Workflows
- Detailed workflows
- Service Task modelling
- UI prototyping
- Process Simulation:
 - Configure Resources need for tasks
 - Load profiles in sec/min/days/no.of instances
 - Start the Process Simulation as a Service (PSSaaS)



SOA Requirements with use case modelling, story cards, (Agile), Story Boards, CRC Cards, Feature-Oriented modelling




SOA Design with Service Component Models (Design Techniques using UML component model & SoaML)



SOA Implementation with SOAP/RESTful



SOA Test & Deliver

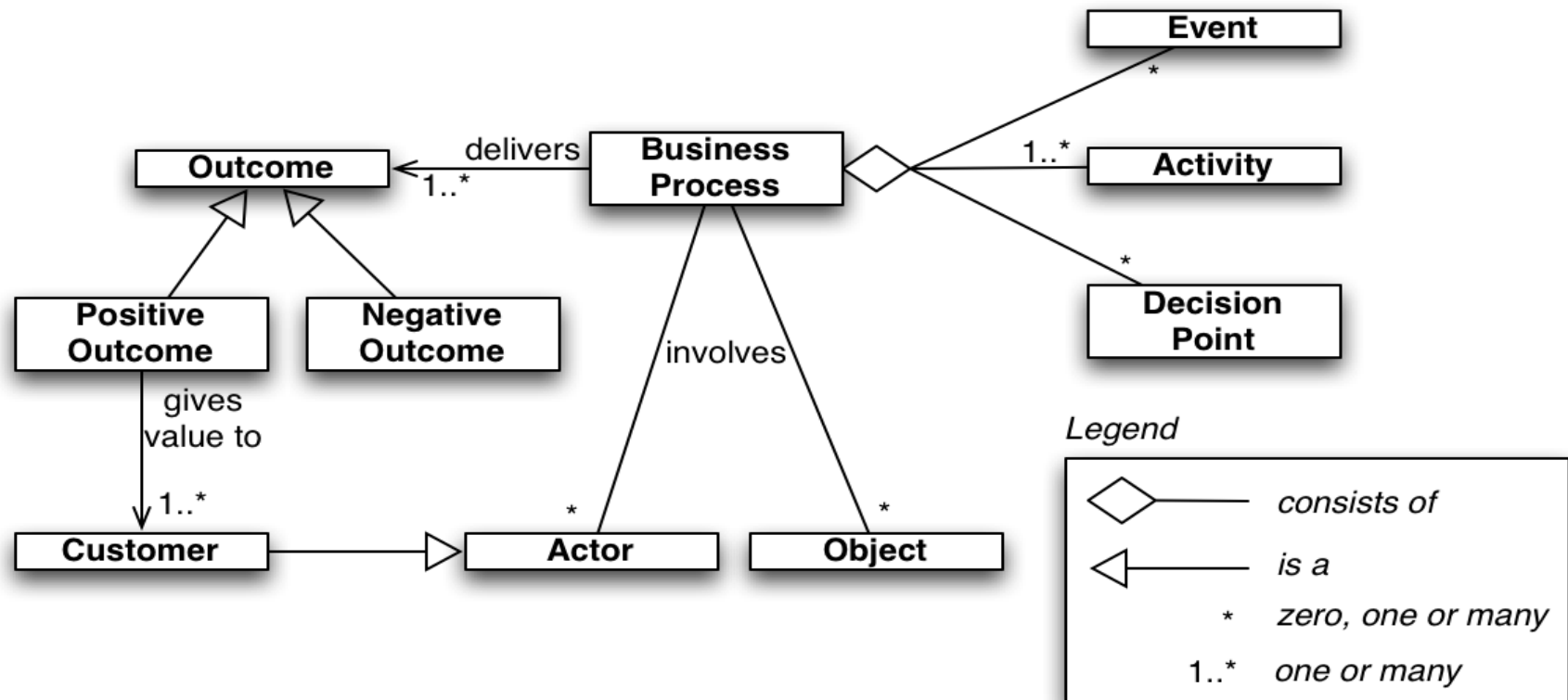


Why BPM (Business Process Management =
BPMN+CMMN+DMN) for Financial Services and Financial Cloud
Based Applications?

WHAT & WHY BPMN-CMMN- DMN?

**(BUSINESS PROCESS MODELLING NOTATION FOR
BUSINESS PROCESS MANAGEMENT)**

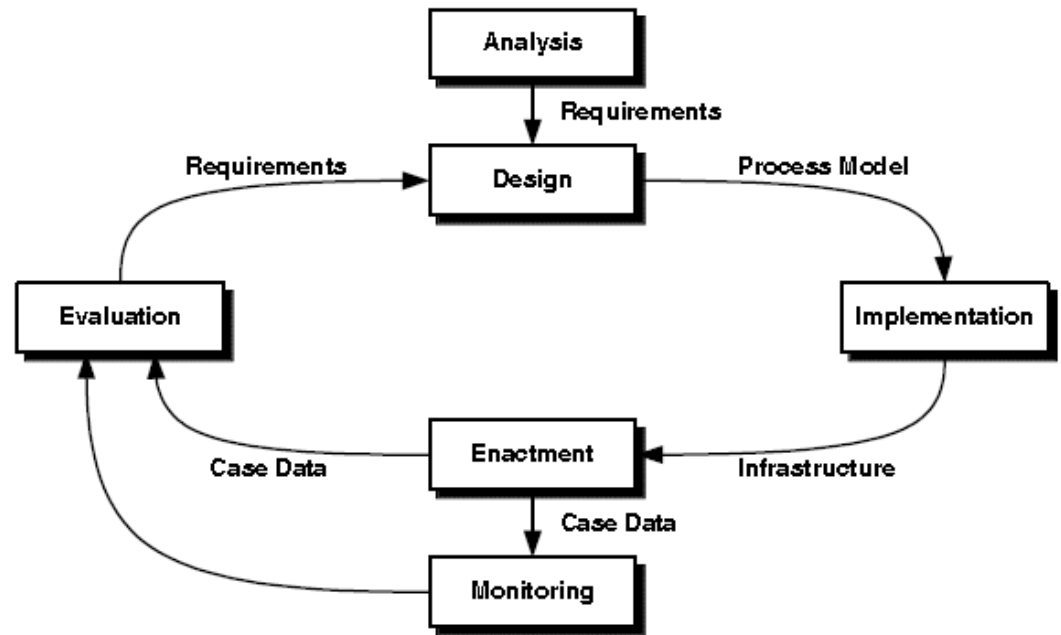
What is BPMN?



Why BPMN?

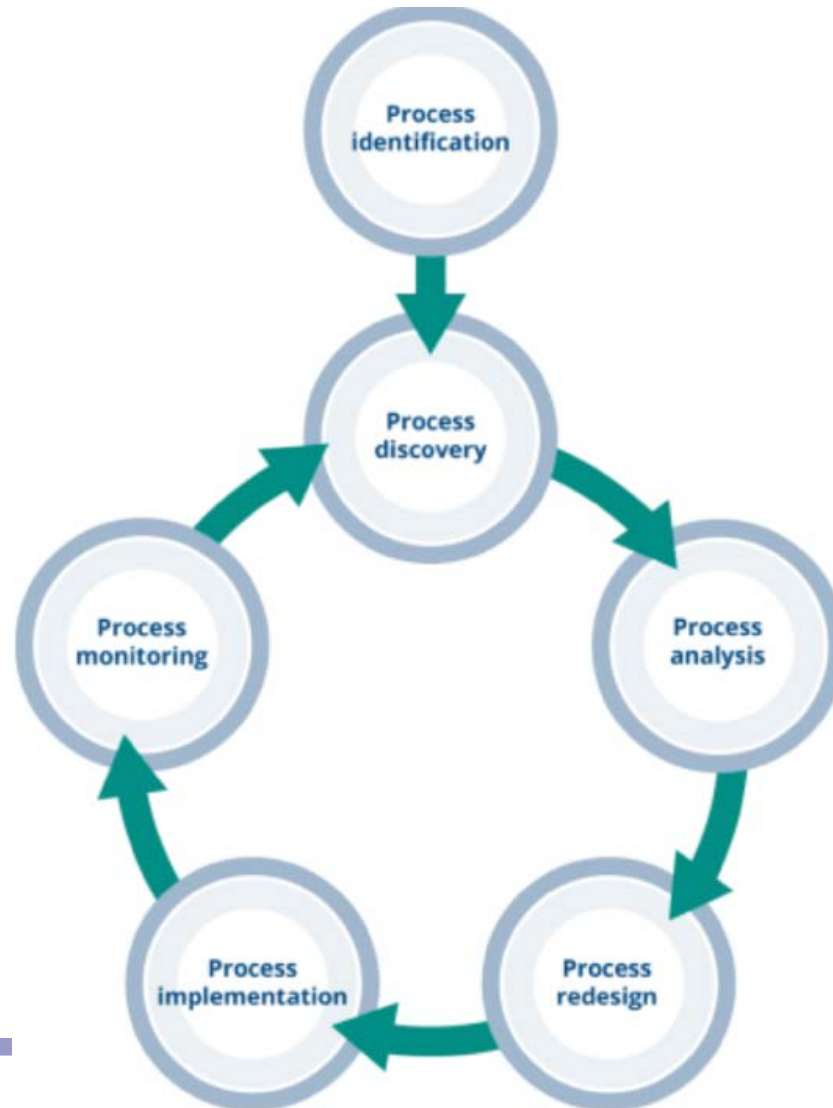
The life cycle comprises the management activities of analysis, design, implementation, enactment, monitoring and evaluation:

- Allows us to identify services
- Useful as a Requirements Engineering method
- Allows us to study process effectiveness, performance, and efficiency requirements
- Validating Big Data Analytics (learn from existing business process effectiveness)
- Evaluation of services, business, etc
- We can't guarantee QoS if we haven't validated the planned business process
- Changing nature of the businesses
- **Managing Digital revolution: Service and cloud computing, Big Data, IoT, and Blockchain Technologies**

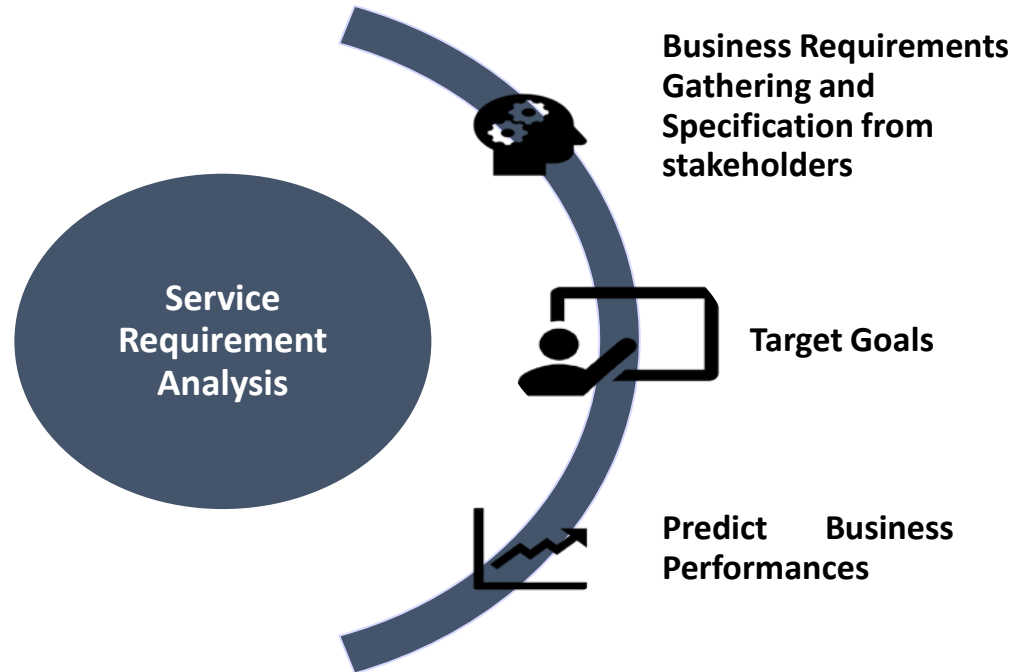


Business process management life cycle

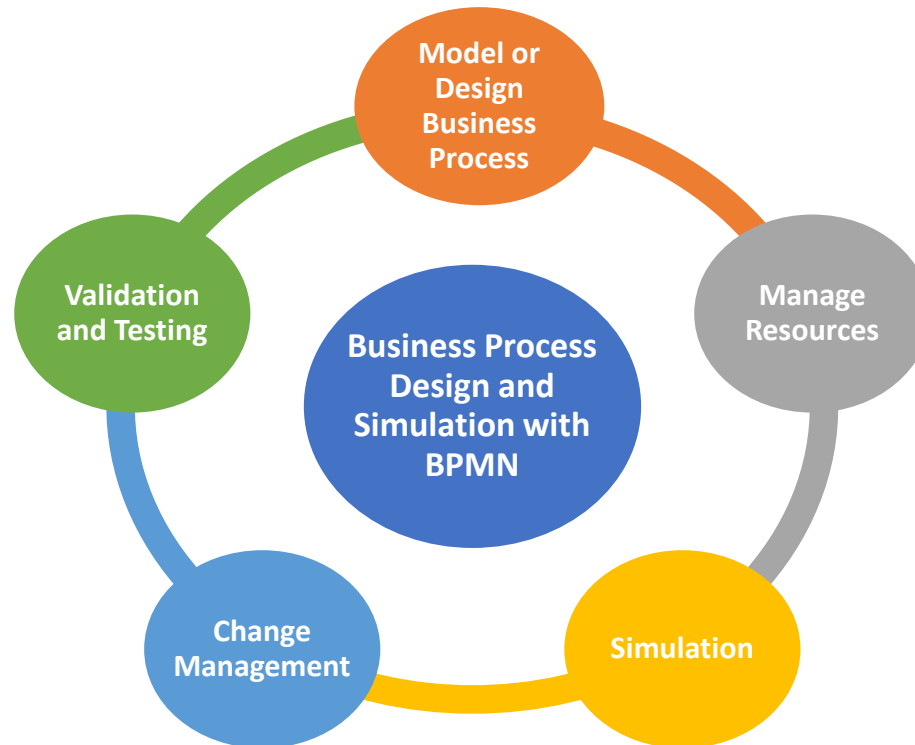
BPM Life Cycle



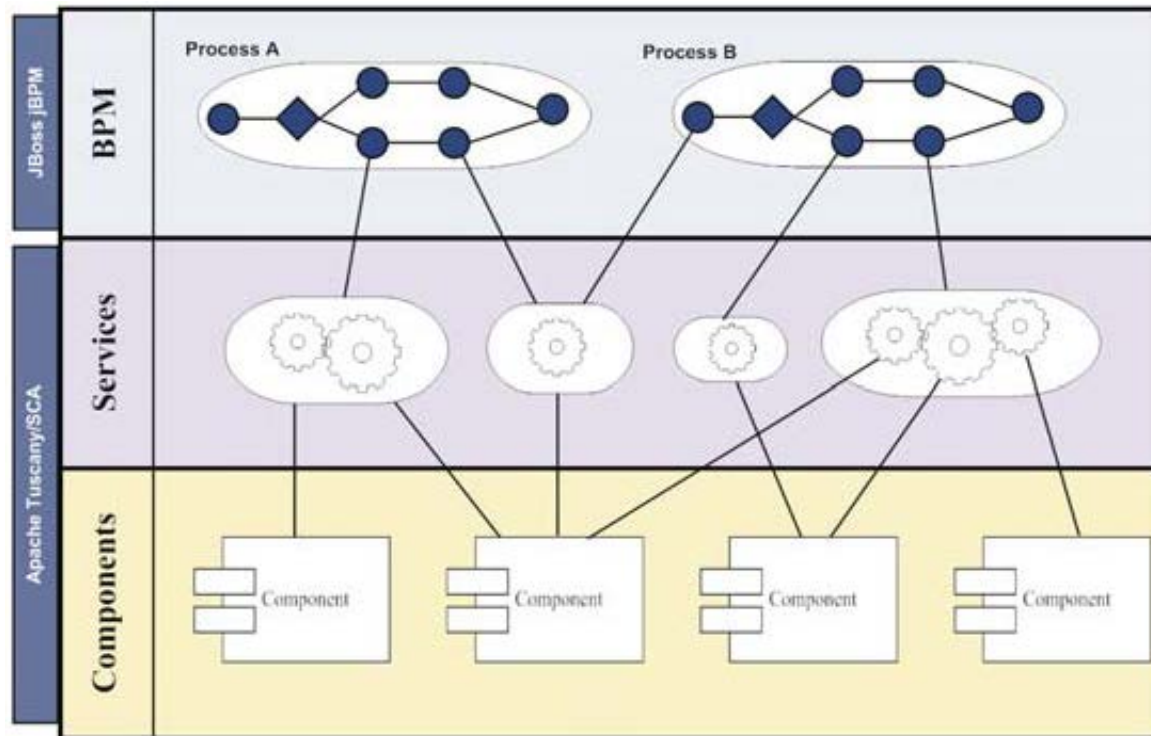
Business Requirements Gathering Technique



Business Process Design, Simulation, and Validation

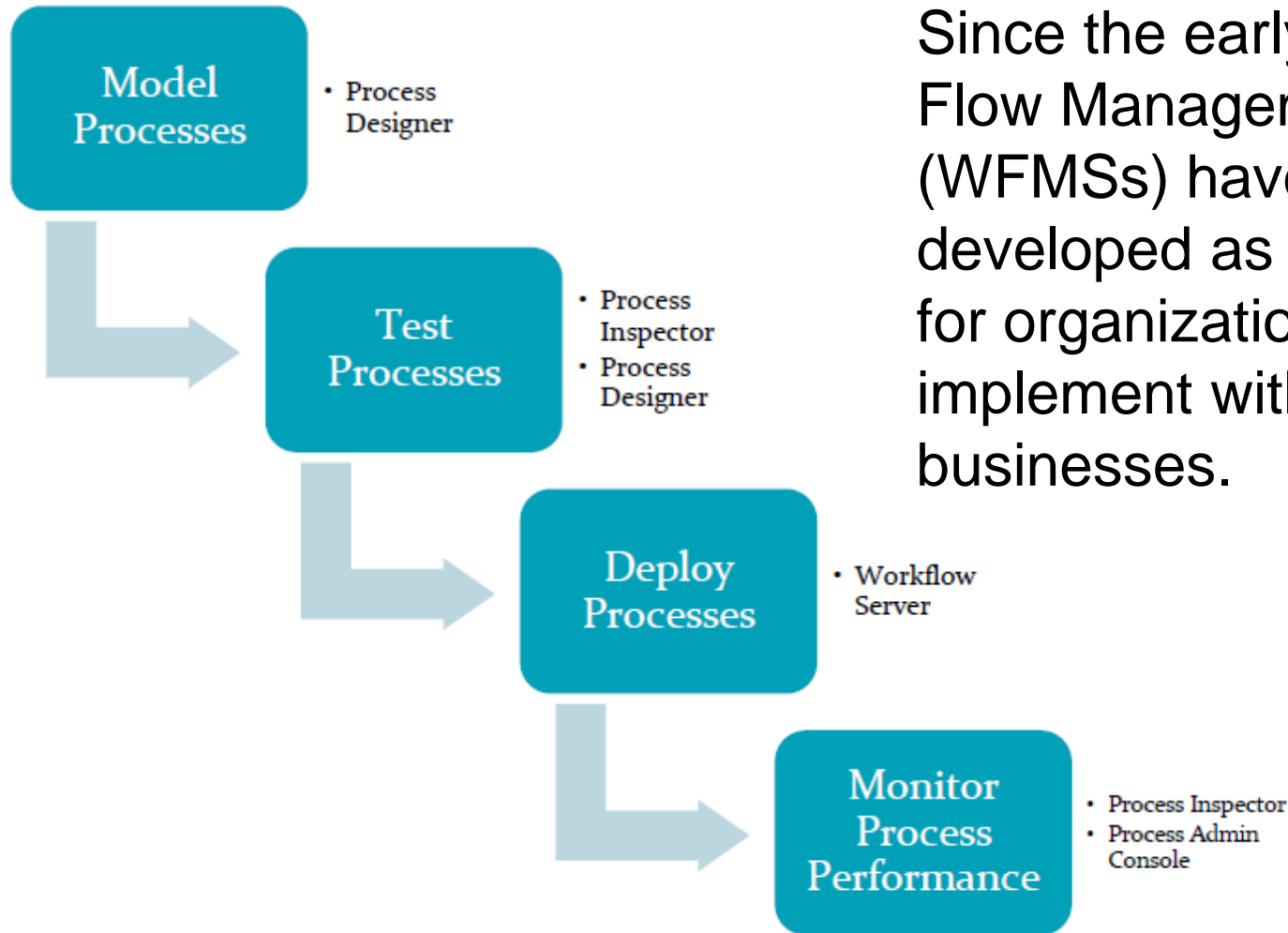


BPM: the “secret sauce” of SOA



The relationship among BPM, services, and components
Davis, J (2009) Open Source SOA, Manning Publisher

Work Flow Management Systems (WFMSs)



Since the early nineties, Work Flow Management Systems (WFMSs) have been developed as a global market for organizations to implement within their businesses.

Triple Crown Processes

- BPMN (Business Process Modeling Notation) is the new developing detail for making the rupture between the business procedure plan and the procedure execution.
- CMMN (Case Management Modelling Notation) is pushing the boundary to create easy to use software and the newest addition,
- DMN (Decision Modelling Notation) is empowering business flexibility.
- OMG standards

Why Should You Care?

- Processes are at the core of any organisation, yet they are not always clearly defined, documented or optimised
- The need to bridge the communication gap between business and IT is stronger then ever
- As the rate of change in the business environment increases and with greater pressure to become more efficient; organisations must form a clear view of how their processes operate
- BPMN offers a notation that you can use to document your own processes without ambiguity

BPMN-CMMN-DMN

Core management practices



Process Management



Case Management



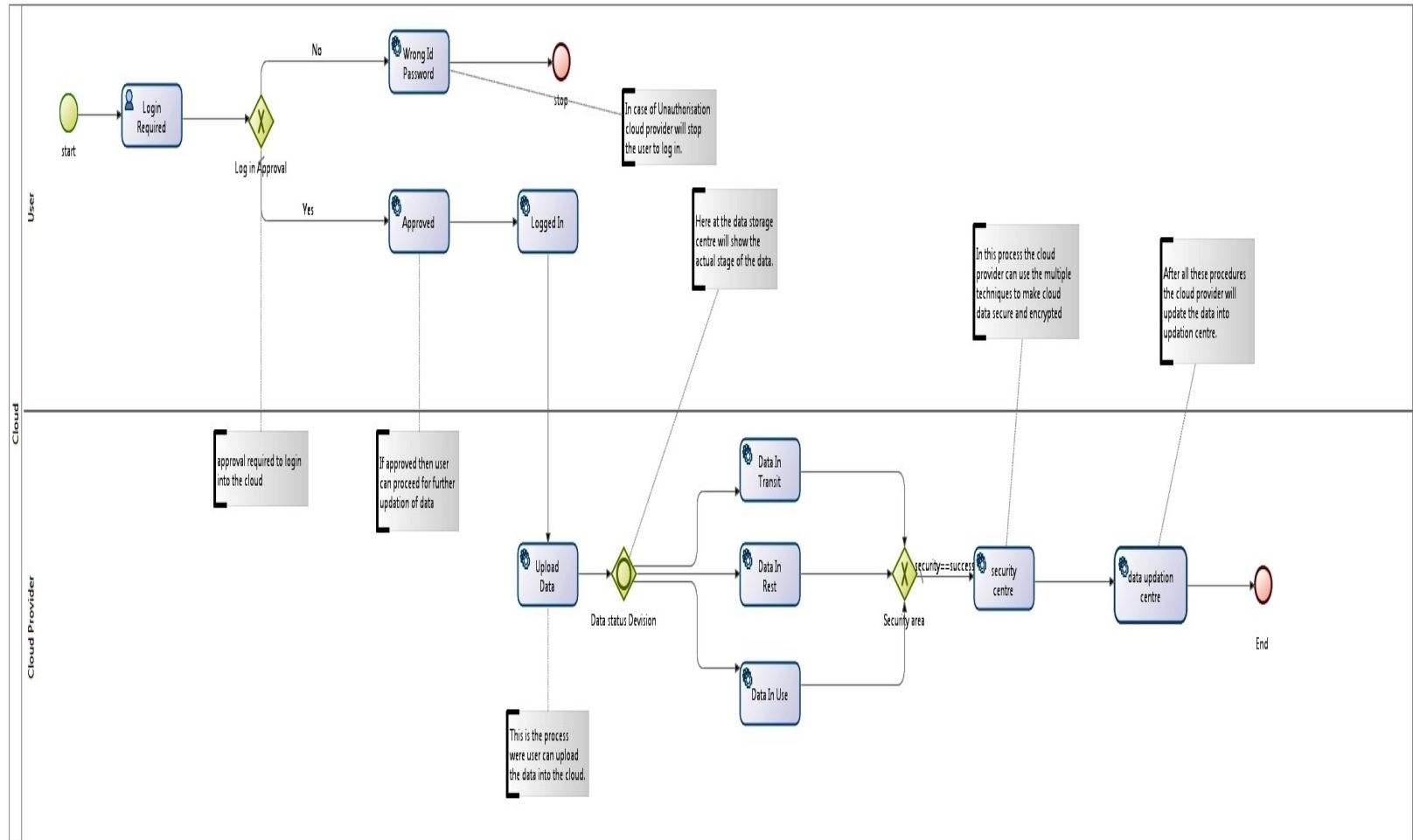
Decision Management

BPMN: Business Process Modelling Notation

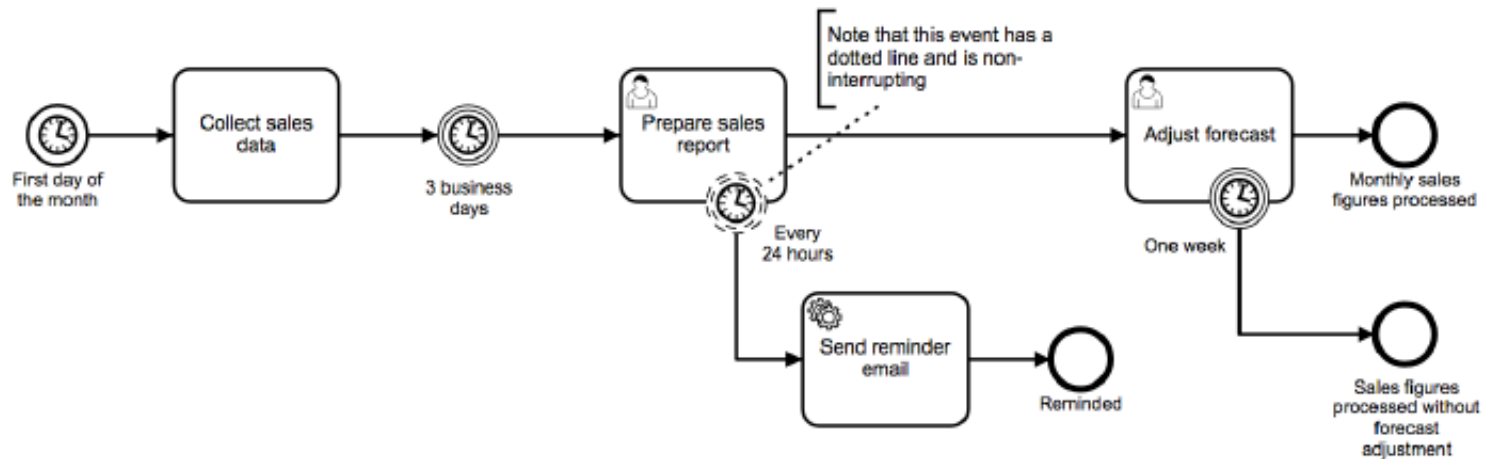
CMMN: Case Management Modelling Notation

DMN: Decision Modelling Notation

Example BPMN Model for a Cloud Data Security Process



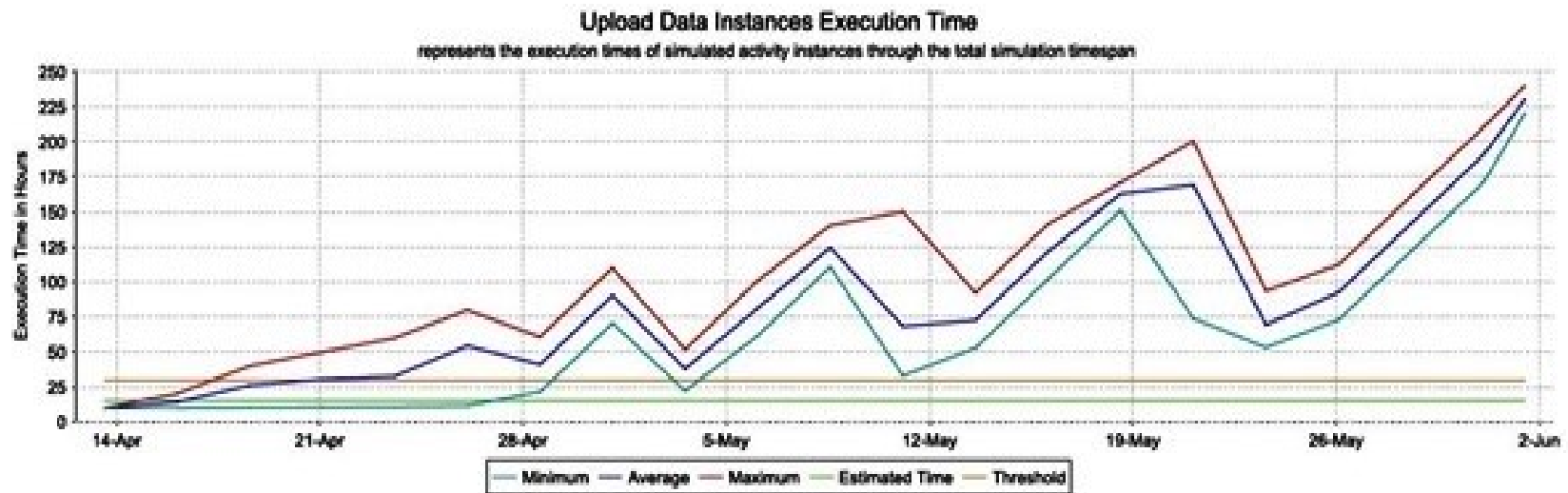
Different Types of timers events



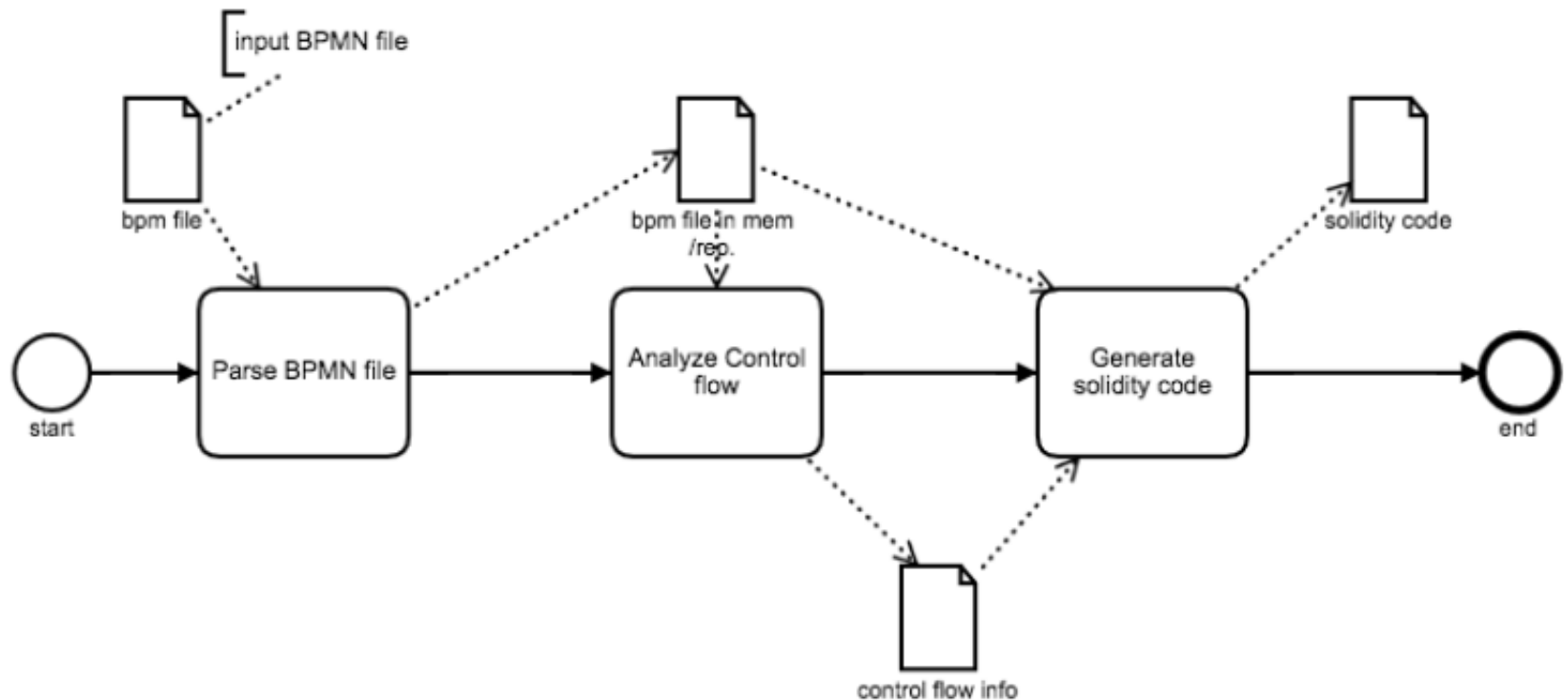
BPMN provides four variants of timer event, with two of them being interrupting events and the other two being non-interrupting events. Usually, an interrupting event would abruptly interrupt the execution of an ongoing subprocess or task when a deadline is reached. An non-interrupting event, on the other hand, is used for triggering some background and/or parallel processing at a given time, without stopping the ongoing process.

BPMN timers is useful to write smart contracts for Blockchain Technology. Smart Contracts are computer programs that can be deployed and ran on the blockchain. The Ethereum consortium has defined the following **contract-oriented programming languages**:
Serpent[Ethb] or Solidify[Ethc]

Simulation Result



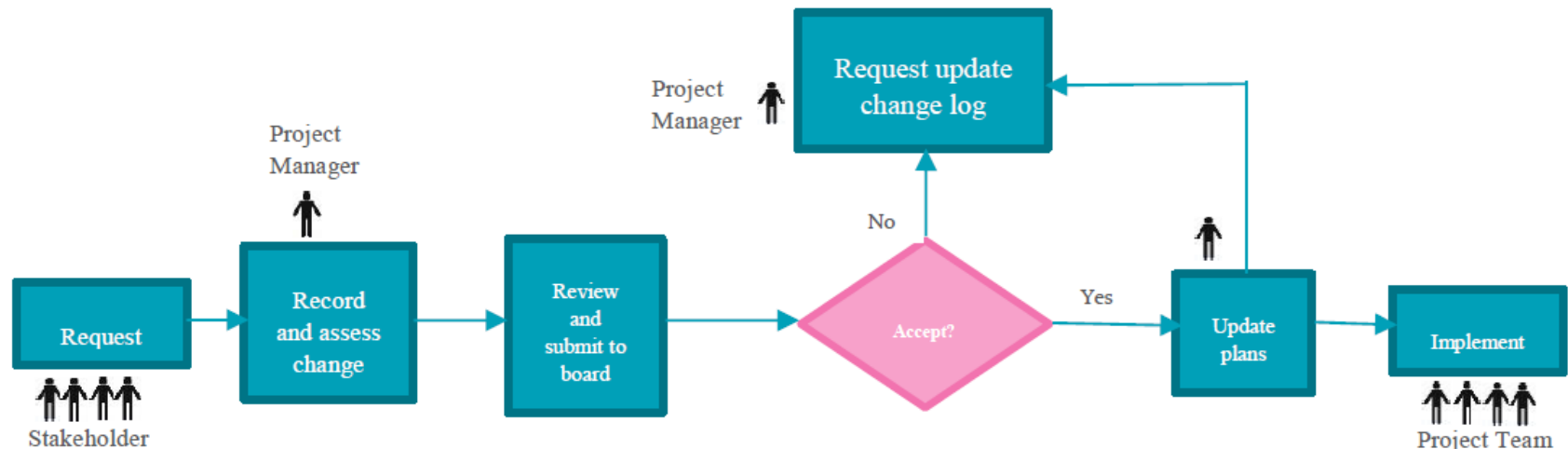
Automation and code generation tool from BPMN Engine



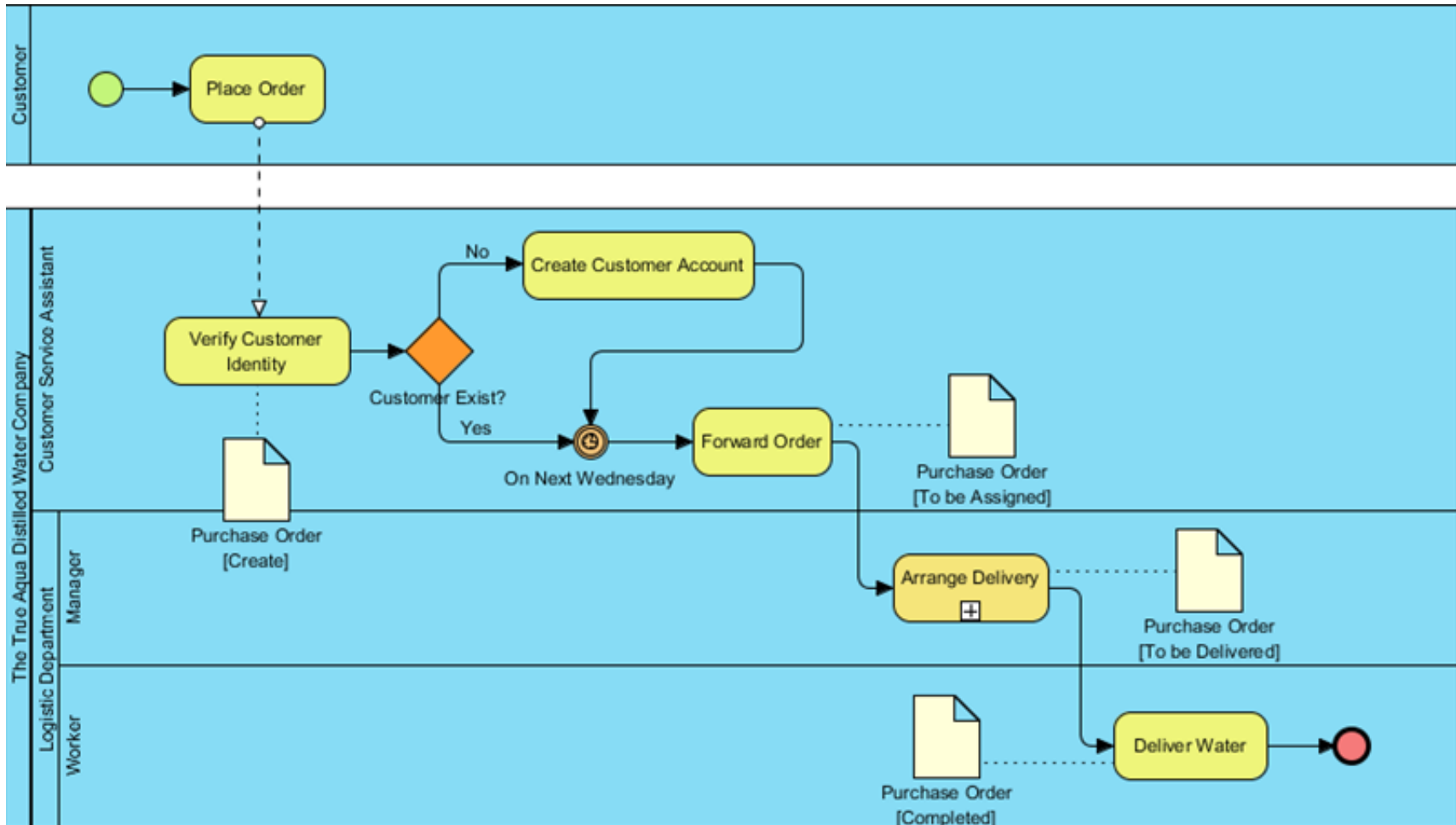


WORKFLOW MANAGEMENT WITH BPMN

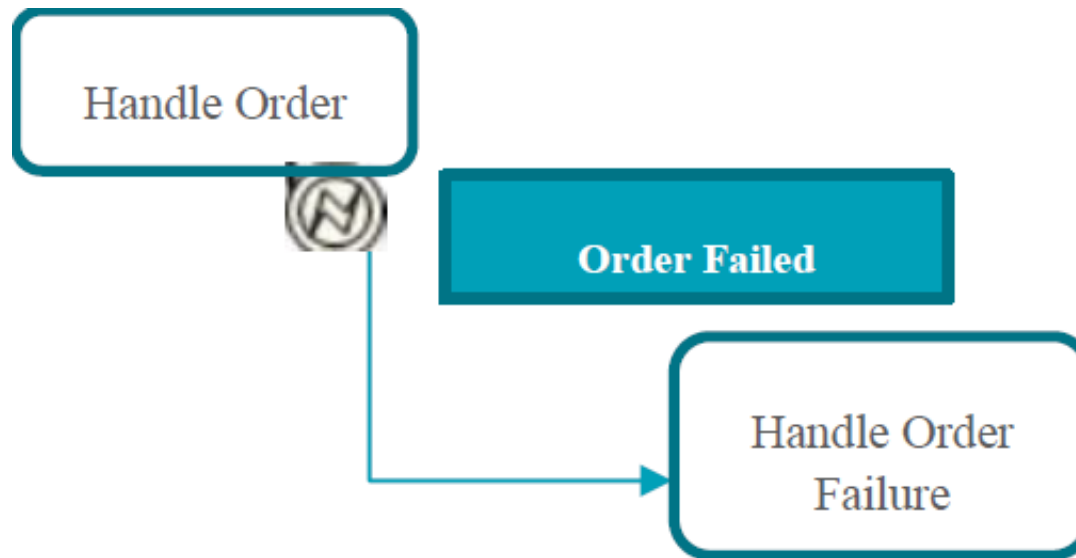
Represents an example of a Work Flow Management System in a business setting



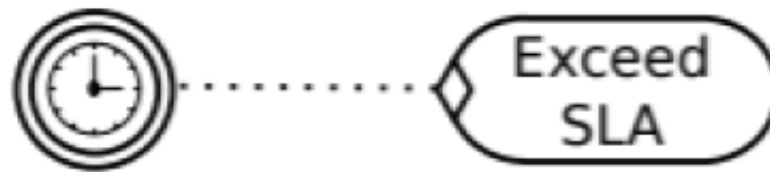
We can simulate and validate workflow & required resources within minute with BPMN simulation tools







Represents an error and to identify business risks occurring during the “Handle Order” activity



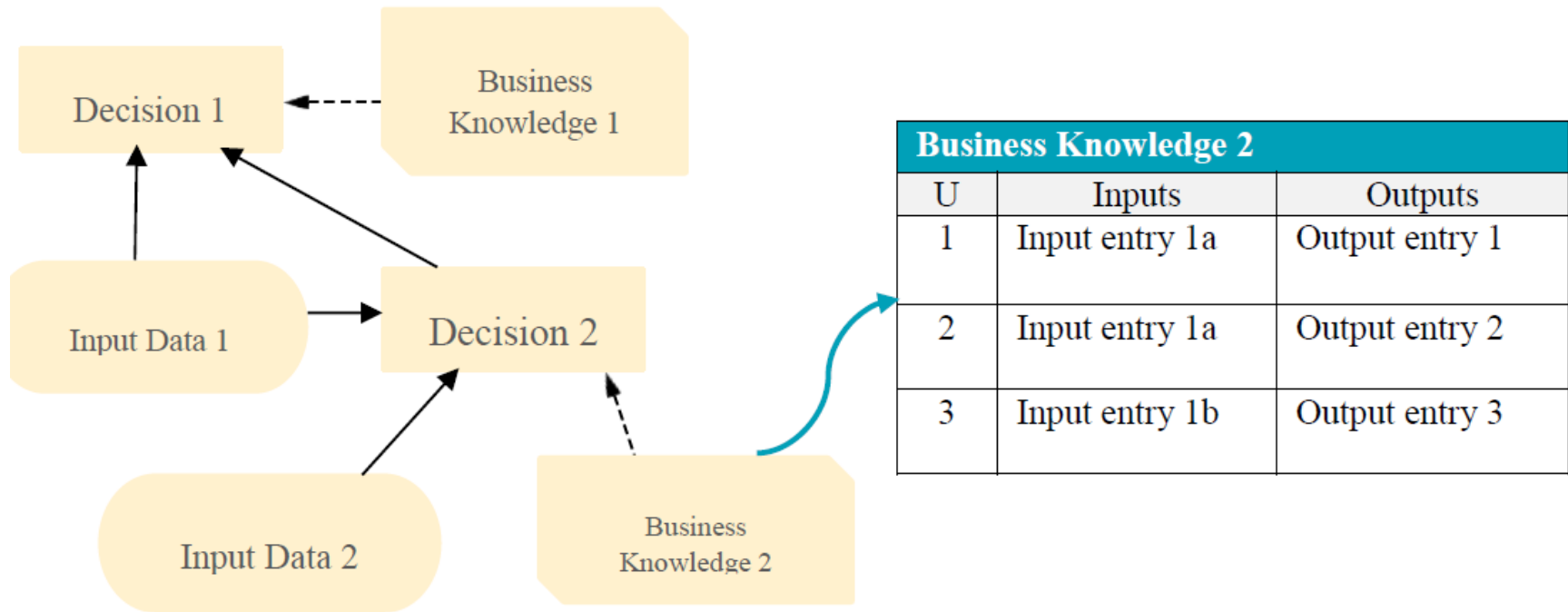
Verify and Validate Business Rules and Risks with SLA and Smart Contract in Blockchain Technology



Decision Management Notation (DMN) allows to validate Business Risks

Component	Notation	Description
Decision		Signifies a point where an output is determined from one or more several inputs, using decision logic. It might require at least one business knowledge models.
Knowledge Source		Portrays an authority, which must be considered amid a decision or business model function.
Input Data		Input Data components contain data which is utilized by one or a few decisions as well as business knowledge models.
Business Knowledge Model		Capacities giving logic to one or various decision components e.g. business rules, analytical model

DMN simulation allows quick validation of the Business Decisions



BPMN Tools

- **Commercial BPMN Tool Reviews**

- [Enterprise Architect \(Sparx Systems\)](#)

Rated 3.5 stars

- [MagicDraw \(No Magic\)](#)

Rated 3.5 stars

- [UModel \(Altova\)](#)

Rated 3 stars

- [Visual Paradigm \(Visual Paradigm\)](#)

Rated 3 stars

- [Rational Software Architect \(IBM\)](#)

Rated 2.5 stars

- **Free & Open Source BPMN Tool Reviews**

- [Modelio \(Open Source\)](#)

Rated 2.5 stars

- BonitaSoft, <https://www.bonitasoft.com/>

- [Tools comparison,](#)

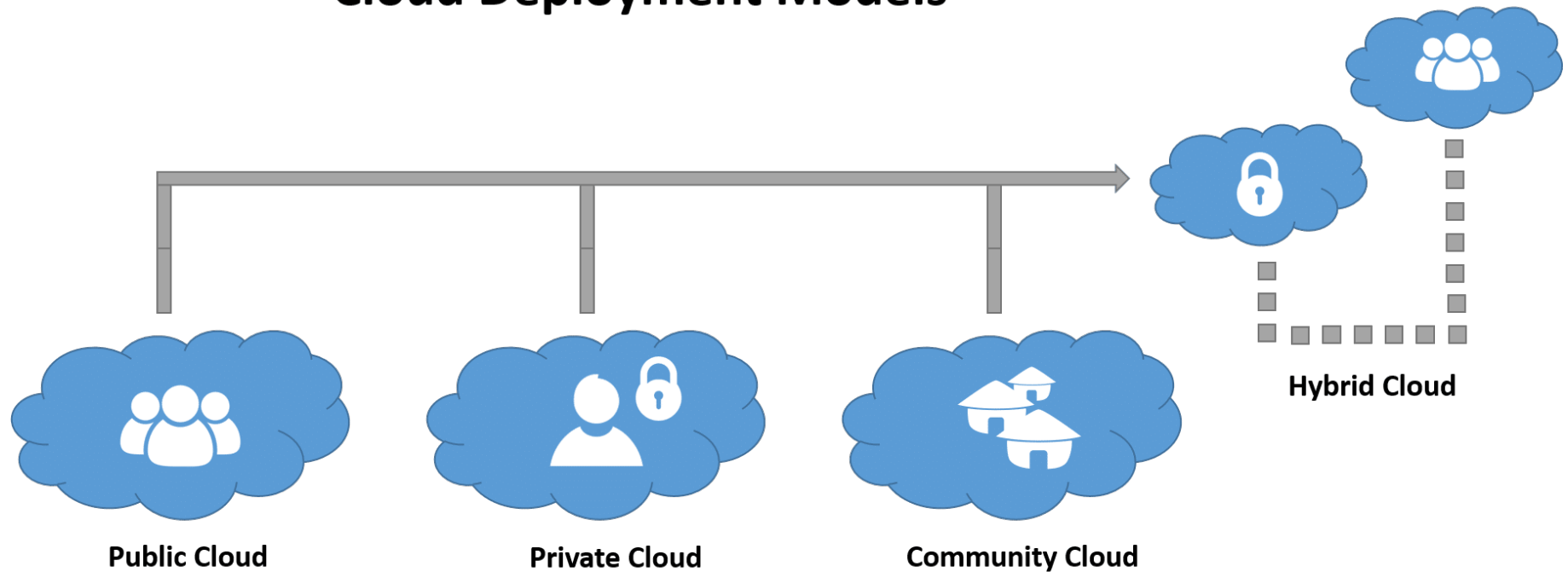
https://en.wikipedia.org/wiki/Comparison_of_Business_Process_Modeling_Notation_tools



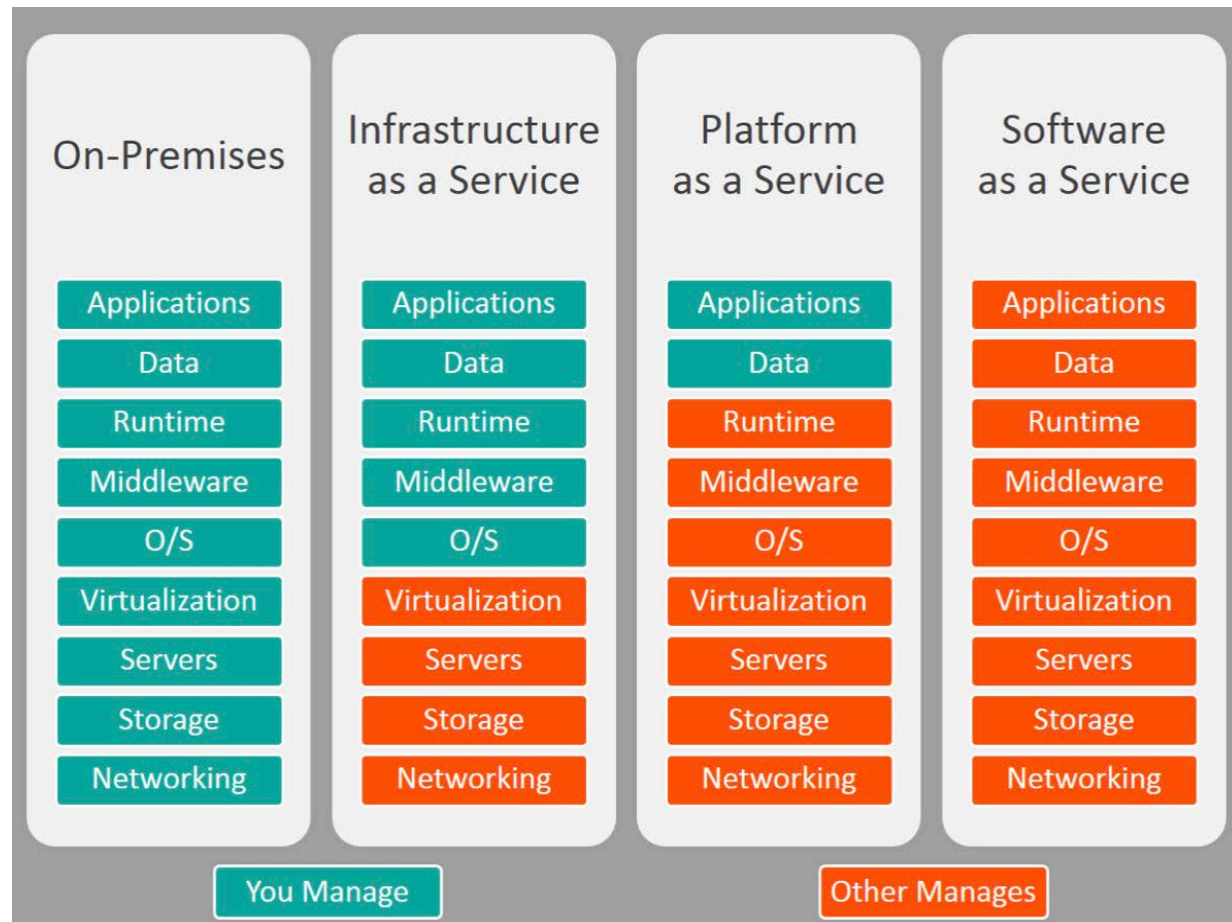
CLOUD DEPLOYMENT MODELS

Cloud Deployment Models

Cloud Deployment Models



Three key services in cloud computing (BMC Blogs, 2019)



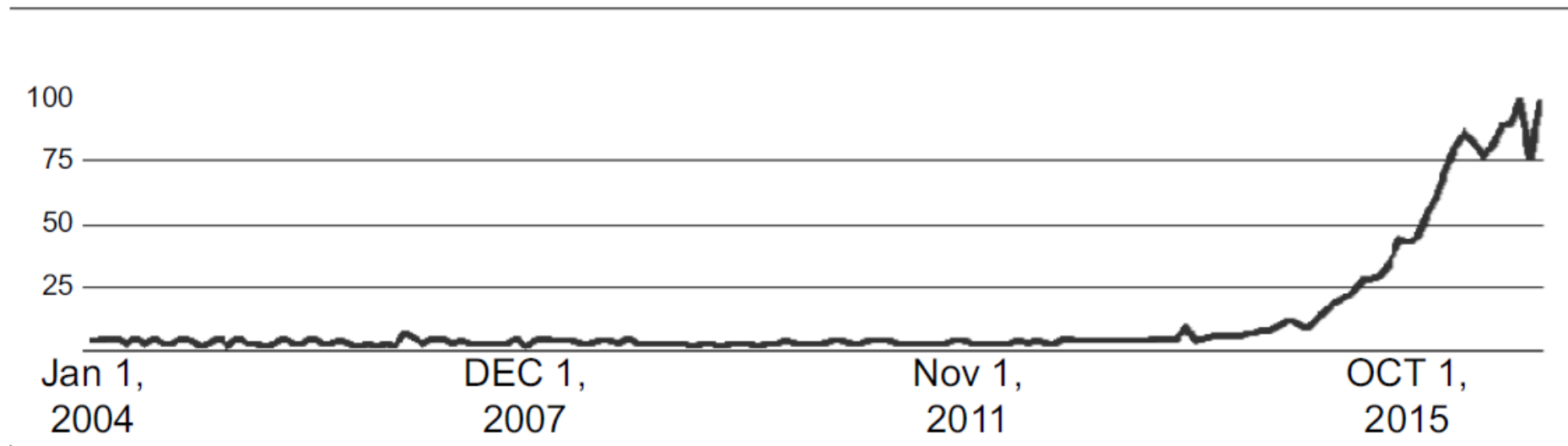


FINANCIAL CLOUD APPLICATIONS & TECHNOLOGIES

Improving the use of Current Technologies for Fintech Growth (Digital Transformation)

- It was inevitable that technology would meet finance and spawn fintech.
- The use of technologies like algorithmic machine learning, collecting massive amounts of data and interpreting them for decision-making or “crystal-ball” predictions (predictive analytics), and distributed ledgers (blockchain) in financial industry will give rise to innovative business models with increased levels of efficiency, productivity, cost-effectiveness while also improving on customer-centricity.
- The most important thing and also a great challenge for both fintech platforms and financial institutions is to adopt and implement a very pertinent, practical, and transparent strategy for digital transformation within the organization as well as in external engagements.

FinTech Growth

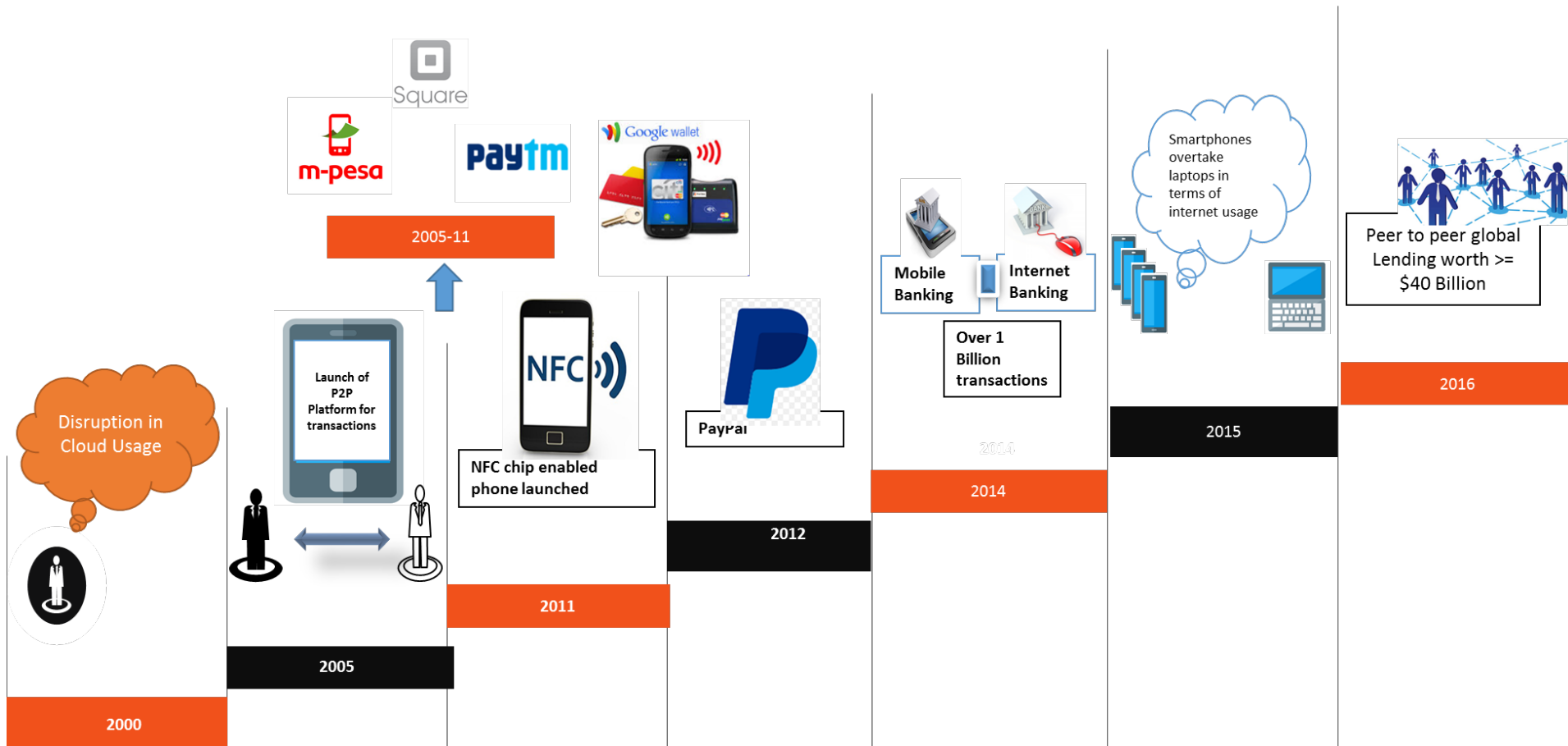




Current Applications

- Crowdfunding
- Peer-to-Peer (P2P) Finances: Lending & Loan
- E-Banking
- E-Insurance
- E-Investments
- E & M-Commerce

FinTech

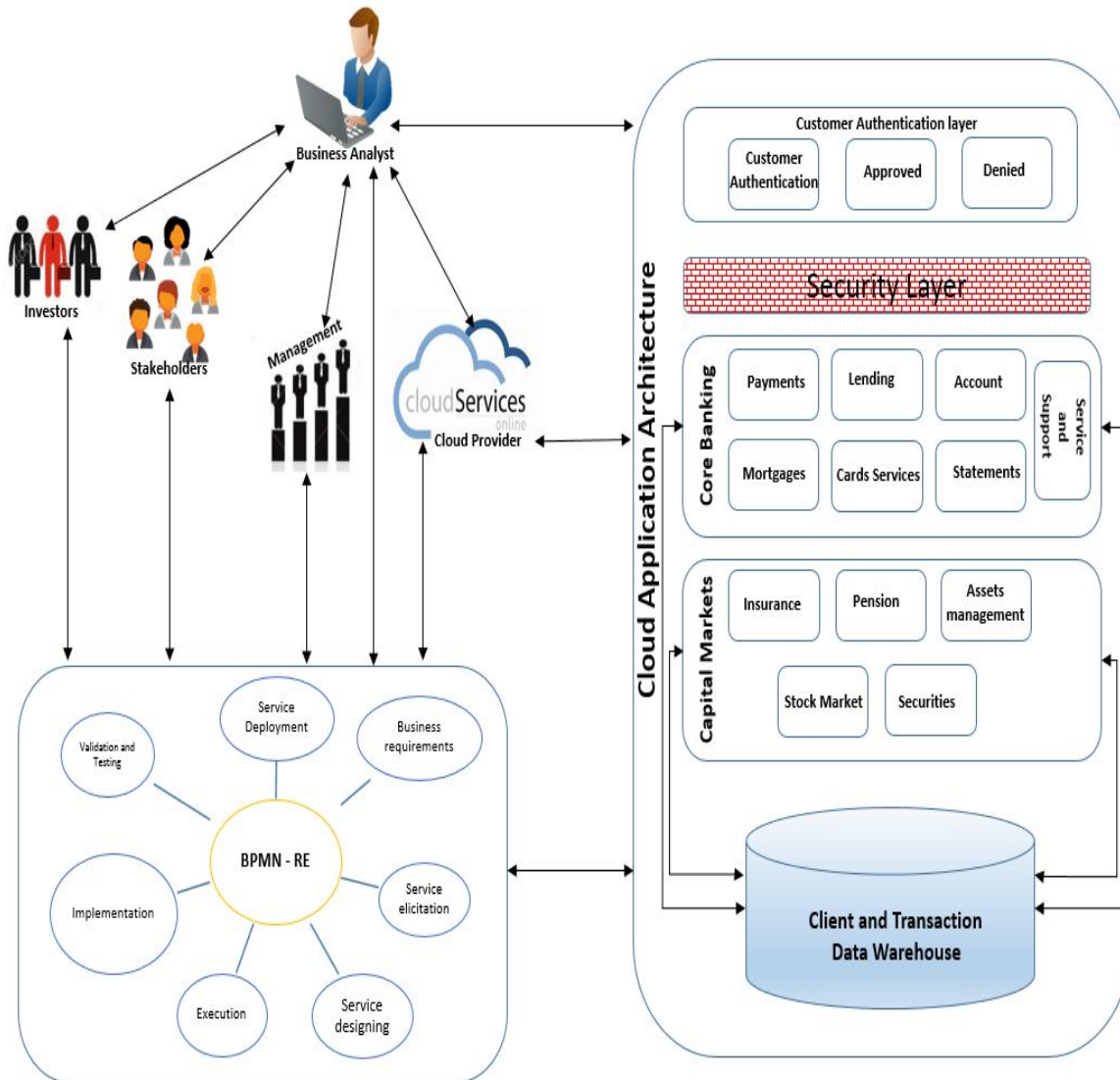




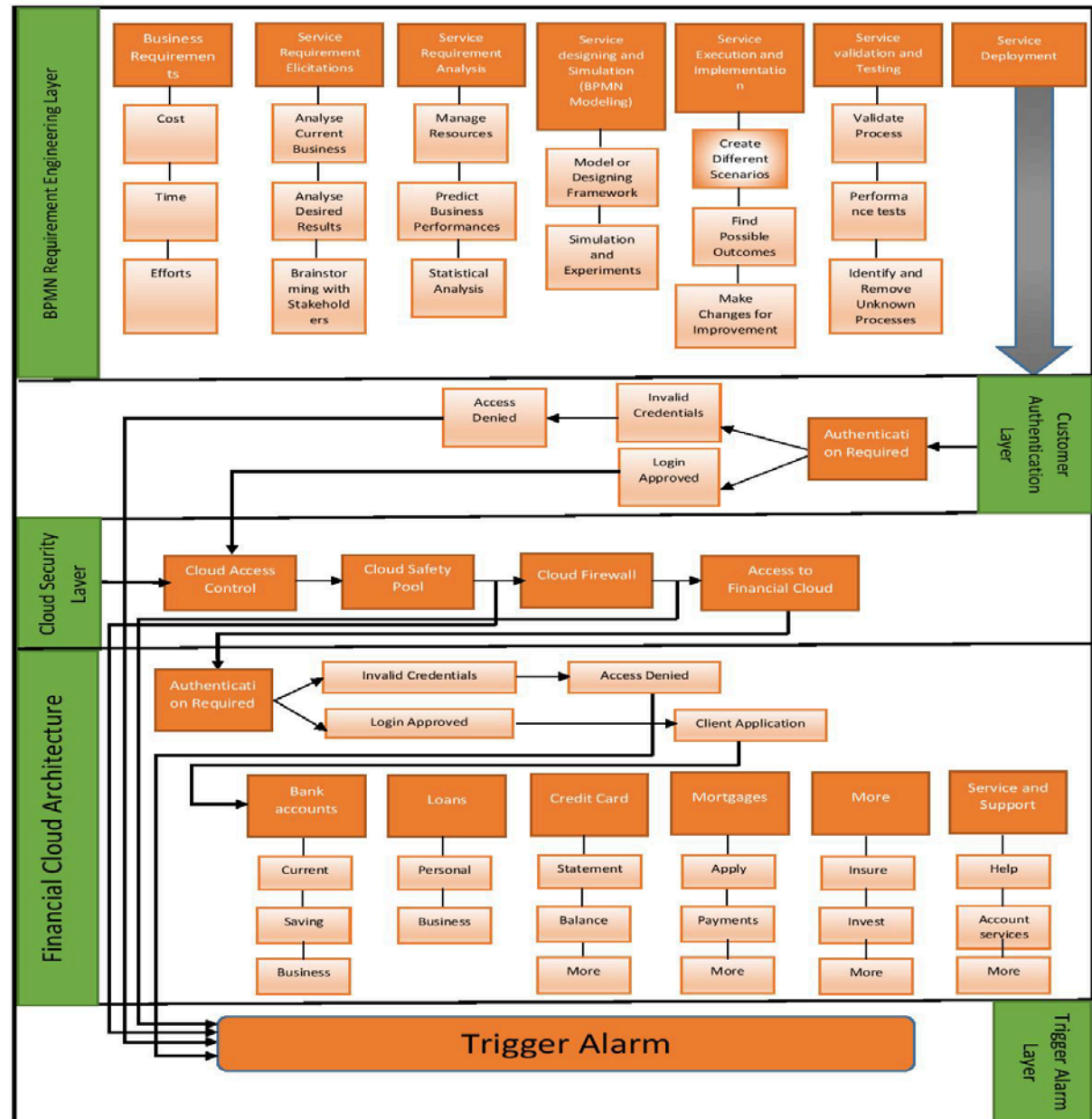
Technologies

- E-Commerce
 - Machine Learning and AI
 - Big Data Analytics
 - Predictive Analytics for Decision-Making (Crytal-bal)
 - Blockchain
 - IoT
 - Cryptocurrencies (Bitcoin vs Ethereum (ETH))
-

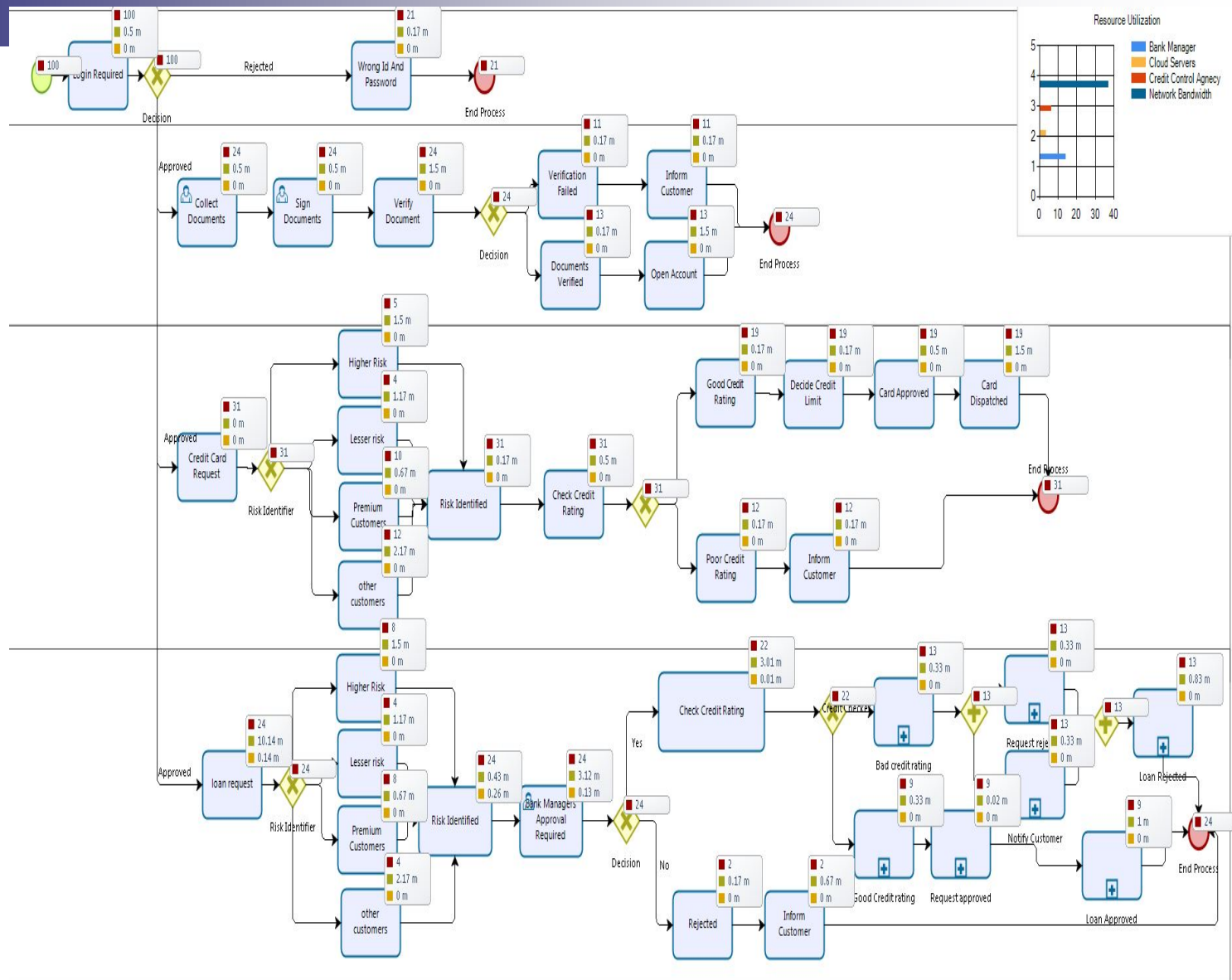
Integrated Financial Cloud Services



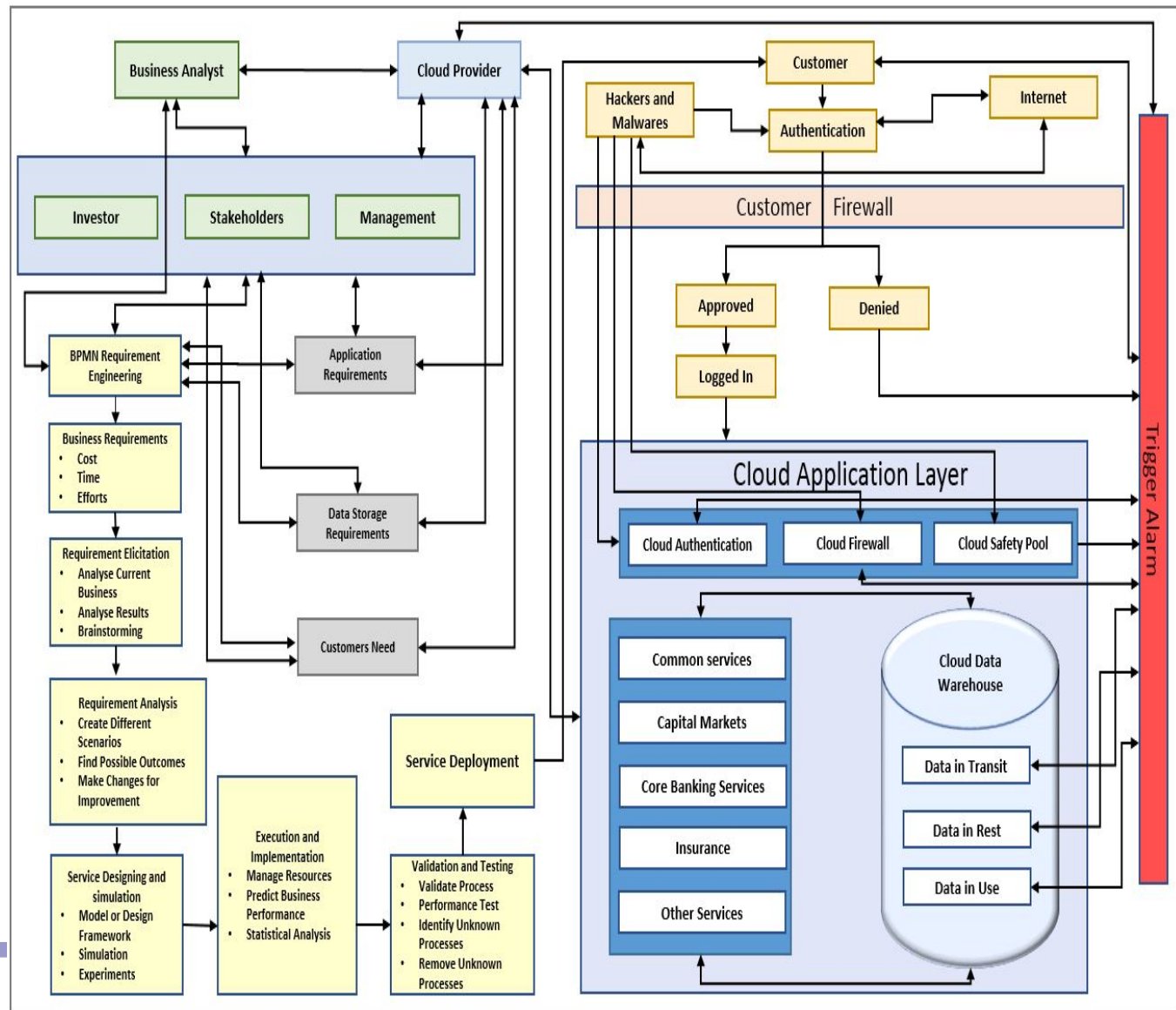
Financial Cloud Services



Simulation View of the Financial Cloud Services



Reference Framework for Financial Cloud Services



Business Process Intelligence for Process Innovation

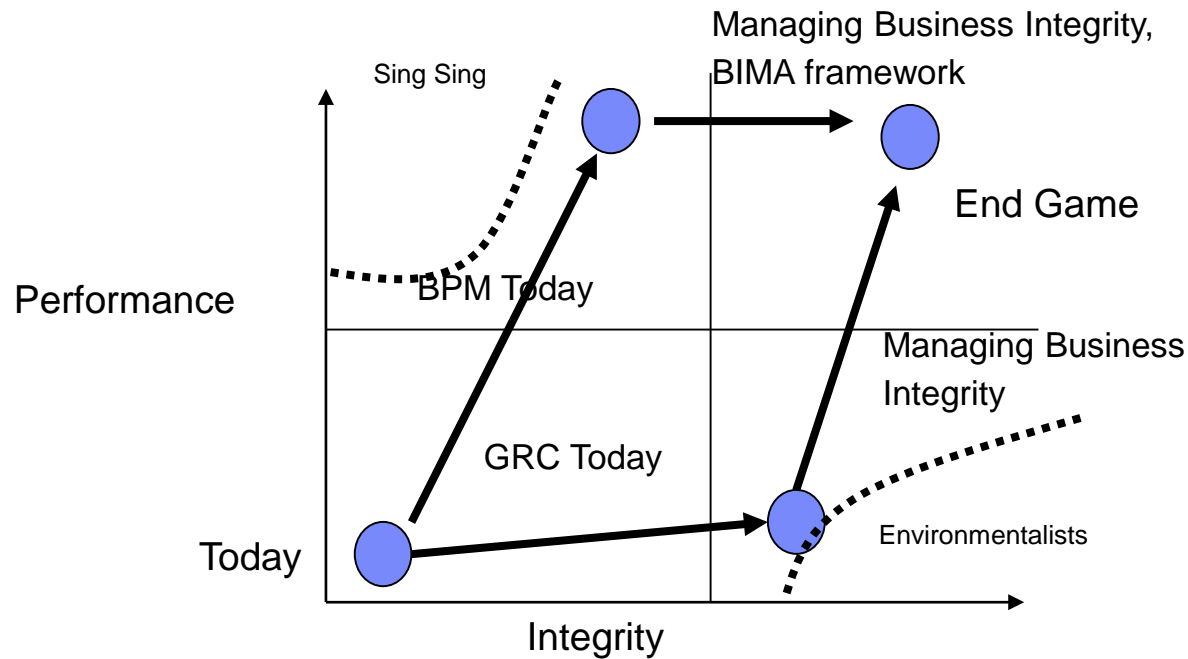
The screenshot displays a web browser window with the URL <https://data.4tu.nl/repository/uuid:7e326e7e-8b93-4701-8860-71213edf0f0e>. The page is titled "Dataset | BPI Challenge 2017 - Offer log". The left sidebar contains navigation links: Home, Upload datasets, Personal page, Search in Data, and Search in "Info". The main content area shows the dataset details, including the title "BPI Challenge 2017 - Offer log", creator "Gert van Dongen, B.F. (Boudewijn)", contributor "Eindhoven University of Technology", date accepted "2017-02-06", date created "2016-01-01 through 2017-02-01", date published "2017", and description "This event log pertains to a loan application process of a Dutch financial institute. The data contains all offers made for an accepted application in the event log 10.4121/uuid:5f067df-f10b-45da-b98b-86ae4c7a310b. All of the events in this log are also in the BPI Challenge 2017 event log (10.4121/uuid:5f067df-f10b-45da-b98b-86ae4c7a310b). This subset is provided for convenience and the IDs are persistent between the two datasets." The page also includes a "DATA" section with a table of metadata for the event log, including fields like doi, name, description, and language.

Event Logs Data of Loan Application Process for a Dutch Financial Institution between 2012-17 as part of BPI Challenge, <https://tinyurl.com/bpic2017>



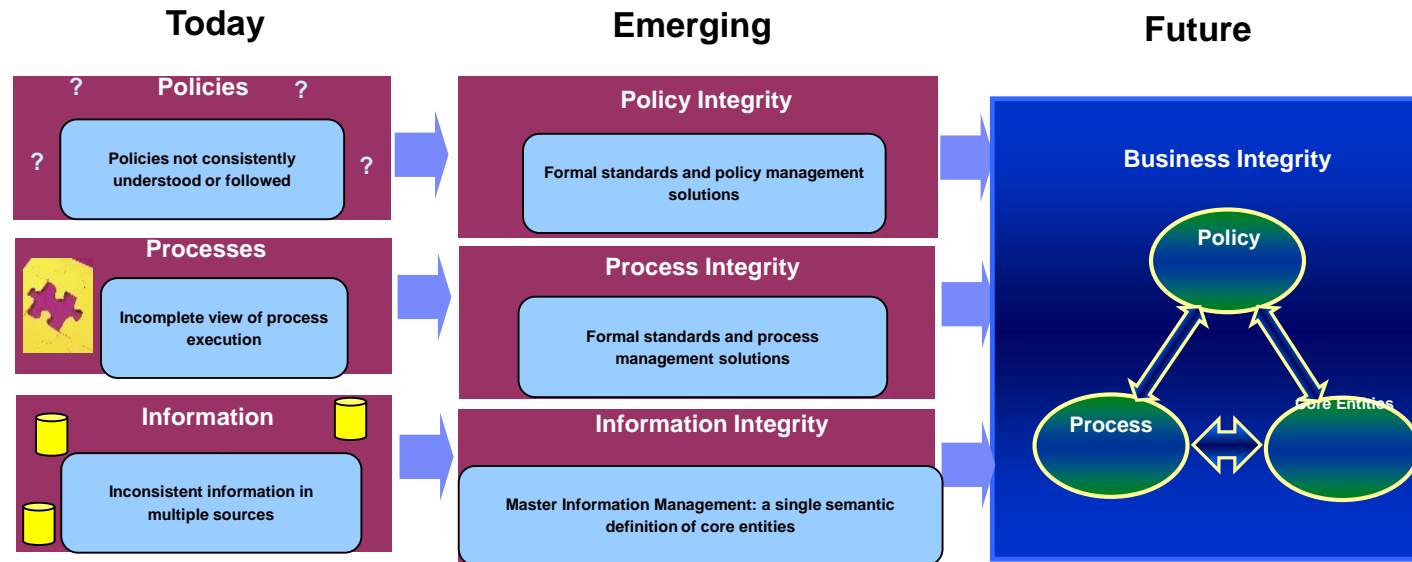
BUSINESS INTEGRITY MODELLING AND ANALYSIS (BIMA)

Relationship between business integrity and performance



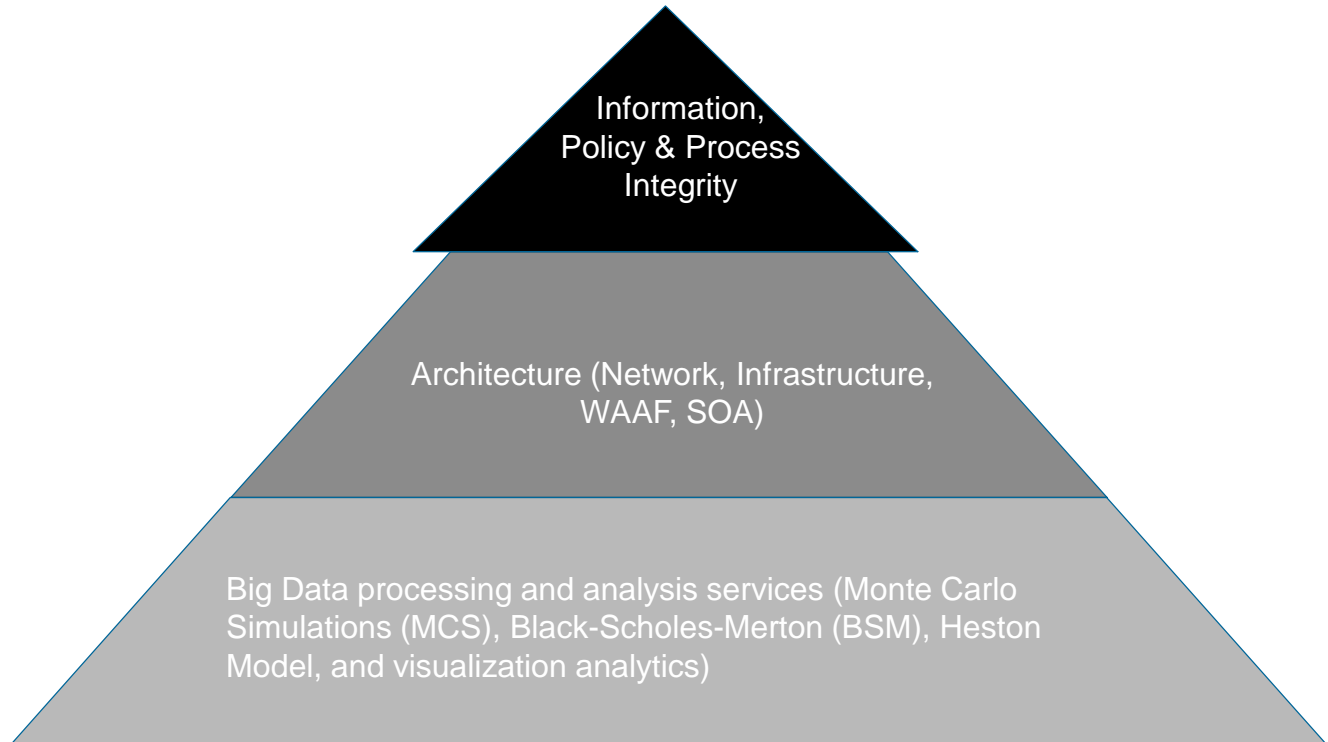
Business performance vs. integrity: identifying and managing risks on governance, social responsibility, process, etc. and to integrate them with Business Information Technologies

The evolution from managing individual integrity for policy, process, and information to managing



- **Information integrity:** Master Information Management (Single semantic definition of core entities (e.g. customer, employee, product))
- **Policy integrity:** Common and/or Best Practices (e.g. accounting practices) stored in policy repository/warehouse
- **Process integrity:** Standardized Business Processes (e.g. enterprise process framework) stored in Process Warehouse (e.g. catalog, models, metadata)

The Pillars of Business Integrity Driven Approach to Implementing Financialization



Our approach to financialization, through the use of the BIMA framework, is the adoption of big data processing and analysis services (BDPAS), which typically run advanced algorithms and advanced formulas to simulate complex, large-scale and real-time financial calculations. BDPAS can process thousands of data at once within seconds with well established algorithms for financial predictions Monte Carlo simulation, Black Scholes Merton model and Heston to model for performing financial and operational risk analysis and present outputs in the form of analytics and visualization.

Key points

- Decisions making is a huge challenge for financial applications and services where AI, ML, Deep Learning can help making decisions and predictions faster
- Blockchain technology can help building trust with application of BPM and BIMA framework

References

67

- Duma, M, La Rosa M, Mendling, J and Reijers, H.A (2018) BPM, 2nd Edition
- **Fintech: AI Powers Financial Services to Improve People's Lives BY YUAN QI/ANT FINANCIAL, JING XIAO/PING AN TECHNOLOGY (SHENZHEN) CO., LTD. NOVEMBER 2018 | VOL. 61 | NO. 11 | COMMUNICATIONS OF THE ACM**, T (2005) SOA: concepts, technology, design, Prentice Hall/Pearson Education
- **Mulvey, M.J. (201) Machine learning and financial planning, IEEE Potential, November/December 2017**
- Elfatraty, A (2007) Dealing with change: components versus services, COMMUNICATIONS OF THE ACM August 2007/Vol. 50, No. 8
- Papazoglou, P. M. et al (2007) Service-oriented computing: state of the art and research challenges, Special Issue on Service-oriented Computing, IEEE Computer, V.40, No.11, November 2007
- Yang, J (2003) Web service componentisation, CACM, October Vol 46/N 10
- Ramachandran, M (2008) Software Components: Guidelines and Applications, Nova Science Publishers, New York, USA. ISBN: 978-1-60456-870-7, October/November 2008,
https://www.novapublishers.com/catalog/product_info.php?products_id=7577 Pages 410
- Ramachandran, M (2011) Software Security Engineering: Design and Applications, Nova Science Publishers, New York, USA, 2011. ISBN: 978-1-61470-128-6, https://www.novapublishers.com/catalog/product_info.php?products_id=26331
- Ramachandran, M (Editor) (2011) Knowledge Engineering for Software Development Life Cycles: Support Technologies and Applications, IGI Global Publishers, ISBN-13 978-1609605094, USA, <http://www.igi-global.com/bookstore/titledetails.aspx?titleid=46170>
- Ramachandran, M (2011) Software components for cloud computing architectures and applications, Springer, Mahmood, Z and Hill, R (eds.).
- Ramachandran, M., Zaigham, M., and Pethu, R (2014) Service Mobile and Web 2.0 Technologies for Connected E-Governm
- Ramachandran, M (2013) Business Requirements Engineering Engineering Frameworks for Cloud Computing Paradigm, Ma
<http://www.springer.com/computer/communication+network>

