Unified Modeling Language (UML)

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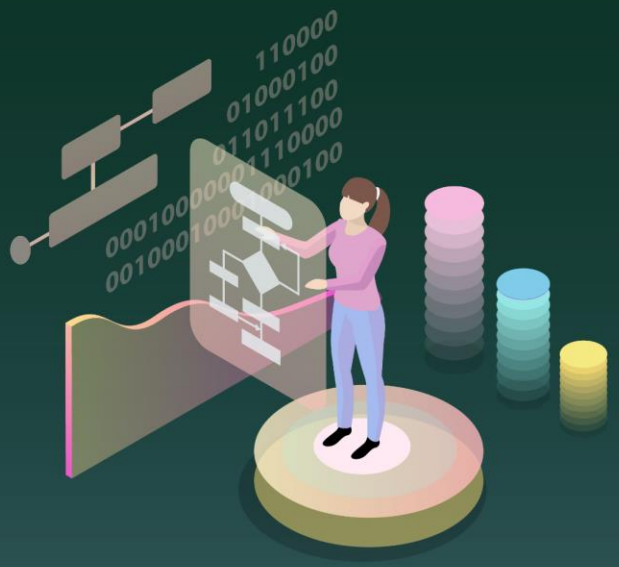
08118228331



Romi Satria Wahono

- SMA Taruna Nusantara Magelang (1993)
- B.Eng, M.Eng and Ph.D in Software Engineering
  Saitama University Japan (1994-2004)
  Universiti Teknikal Malaysia Melaka (2014)
- Core Competency in Enterprise Architecture, Software Engineering and Machine Learning
- LIPI Researcher (2004-2007)
- Founder and CEO:
  - PT Brainmatics Cipta Informatika (2005)
  - PT IlmuKomputerCom Braindevs Sistema (2014)
- Professional Member of IEEE, ACM and PMI
- IT and Research Award Winners from WSIS (United Nations), Kemdikbud, Ristekdikti, LIPI, etc
- SCOPUS/ISI Indexed Q1 Journal Reviewer: Information and Software Technology, Journal of Systems and Software, Software: Practice and Experience, Empirical Software Engineering, etc
- Industrial IT Certifications: TOGAF, ITIL, CCAI, CCNA, etc
- Enterprise Architecture Consultant: KPK, RistekDikti, INSW, BPPT, Kemsos Kemenkeu (Itjend, DJBC, DJPK), Telkom, FIF, PLN, PJB, Pertamina EP, etc

RomiSatriaWahono.Net

Lecture Notes in Software Engineering, Computing Research and Technopreneurship

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10K views • 5 years ago

Kuliah 20 Menit tentang Metodologi Penelitian

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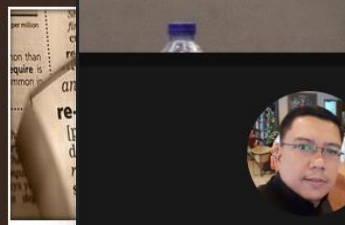

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October 2013)

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BRAINDEVS

1 Hour Online Training

Software Engineering Research Trends

Romi Satria Wahono, Ph.D
Researcher & Technopreneur. Founder & CEO PT Braindevs & PT Brainmatics.
TOGAF & ITIL Certified. Enterprise Architect di KPK, Pertamina EP, BPPT, PLN, PJB, FIF, INSW, RistekDikti, Kemenkeu. SCOPUS Q1 Journal Reviewer:
Information & Software Technology, Journal of System & Software, etc.

GRATIS

Jum'at, 8 Mei 2020
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Terbatas 500 Peserta, Registrasi Sebelum
Kamis, 7 Mei 2020, Pukul 17:00 Melalui
sert1hour.brainmatics.com

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Lina	08118228884
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BRAINMATICS

Course Outline

1. System Planning

1.1 Siklus dan Metodologi Pengembangan Software
1.2 System Request dan Feasibility Analysis

2. Systems Analysis

2.1 Requirement Gathering
2.2 Identifikasi Proses Bisnis dengan Use Case Diagram
2.3 Pemodelan Proses Bisnis dengan AD atau BPMN
2.4 Realisasi Proses Bisnis dengan Sequence Diagram

3. Systems Design

3.1 Perancangan Class Diagram
3.3 Perancangan User Interface Design
3.4 Perancangan Data Model
3.5 Perancangan Deployment Diagram

1. Systems Planning

1.1 Siklus dan Metodologi Pengembangan Software

Siklus Pengembangan Software:

Alur, Peran, dan Tahapan (*Deliverable*) *(Tilley, 2012) (Dennis, 2016) (Valacich, 2017)*

1. **User/Product Owner** membawa permintaan kebutuhan (perubahan) software (System Request) ke System Analyst
2. **System Analyst** membuat analisis kelayakan (Feasibility Analysis) dari System Request tersebut

Planning
(System Proposal)

3. Setelah dinyatakan layak, System Analyst melakukan analysis dan design, dan hasilnya adalah System Specification
   - **Business Analyst** membantu System Analyst memahami proses bisnis dari software yang akan dibangun

Analysis and Design
(System Specification)

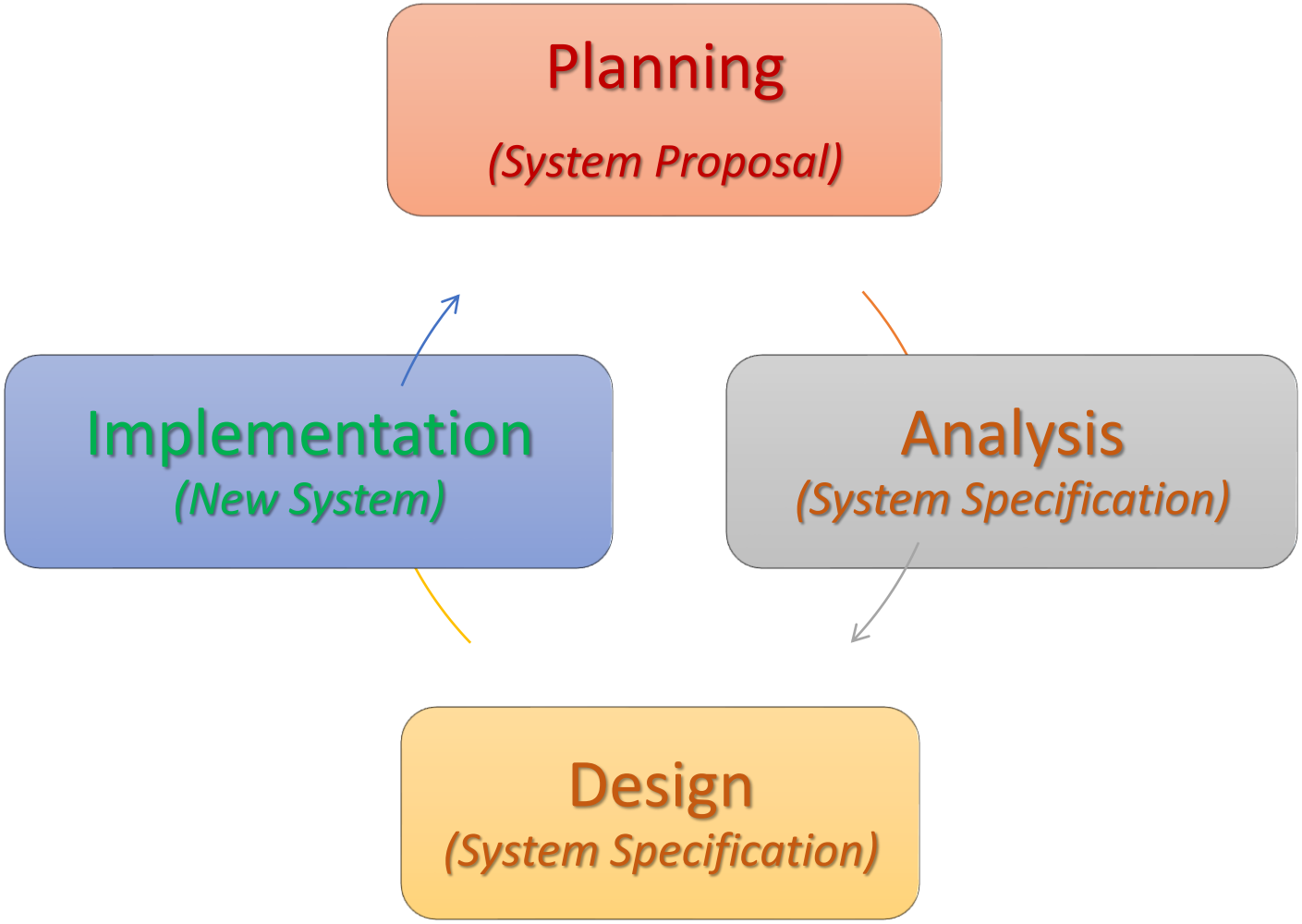
4. System Specification diserahkan oleh System Anayst ke **Programmer** untuk dilakukan Konstruksi (*Coding*)
5. Hasil Konstruksi berupa Kode Program diserahkan ke **Software Tester** untuk dilakukan Pengujian (*Unit, Integration, System, User Acceptance Testing*)
6. Instalasi (*delivery*) software dan manajemen perubahan
   - Software = Kode Program + Dokumentasi (Pengembangan dan Penggunaan)

Implementation
(Software)

7. Siklus kembali ke 1 apabila ada permintaan perubahan (Permintaan Perubahan Software)

Maintenance
(Updated Software)

Siklus Pengembangan Software



(Tilley, 2012) *(Dennis, 2016)* *(Valacich, 2017)*

Metodologi Pengembangan Software (Model Process)

- A formalized approach to implementing the Software Development Life Cycle *(Dennis, 2012)*

- A simplified representation of a software process *(Sommerville, 2015)*

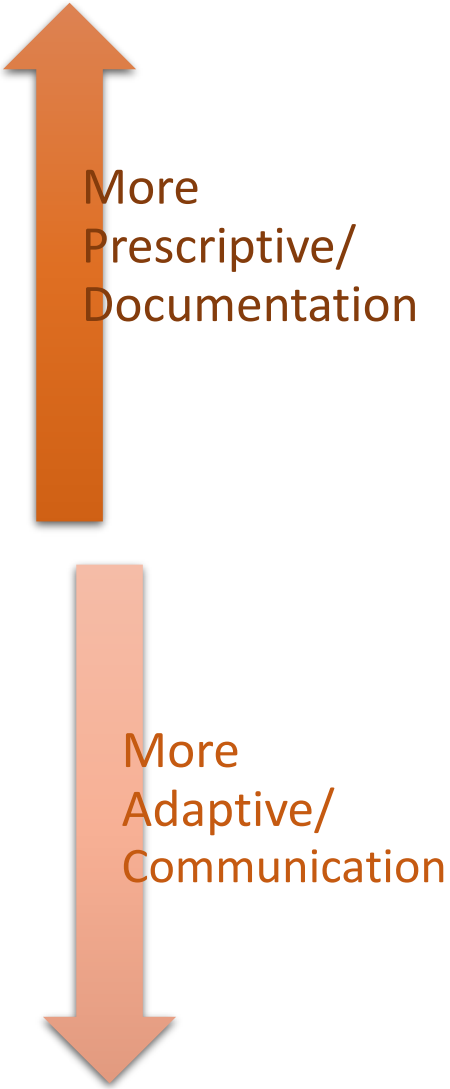
- A distinct set of activities, actions, tasks, milestones, and work products required to engineer high quality software *(Pressman, 2015)*

Metodologi Pengembangan Software

1. **Structured Design**
   (Prescriptive) (1967-)
   - Waterfall method
   - Parallel development

2. **Rapid Application Development**
   (Iterative) (1985-)
   - Phased Development
   - Prototyping

3. **Agile Development**
   (Adaptive) (1995-)
   - Extreme Programming (XP)
   - Scrum



Compiled from (Dennis, Wixom and Tegarden, 2016)

Planning

System Request: Sistem Penjualan Musik Online

Project Sponsor: Margaret Mooney, Vice President of Marketing

Business Needs: Project ini dibangun untuk:

1. Mendapatkan pelanggan baru lewat Internet

Studi Kelayakan Sistem Penjualan Musik Online

Margaret Mooney dan Alec Adams membuat studi kelayakan untuk pengembangan Sistem Penjualan Musik Online

Kelayakan Teknis

Sistem penjualan musik online layak secara teknis, meskipun memiliki beberapa risiko.

	2016	2017	2018
Peningkatan penjualan dari pelanggan baru	0	400,000,000	500,000,000
Peningkatan penjualan dari pelanggan lama	0	600,000,000	700,000,000
Pengurangan biaya operasional dan telepon	0	100,000,000	100,000,000
Total Benefits:	**0**	**1,100,000,000**	**1,300,000,000**
PV of Benefits:	System Request	8,99 084	091 ,35 ,3
PV of All Benefits:	ness Value)	9 8,99 084	070 ,01,1 2
Honor Tim (Planning, Analysis, Design and Implementation)	60,00 ,000	0	
Honor Konsultan Infrastruktur Internet	00,000,000	0	
Total Development Costs:	**450,000,000**	**0**	**0**
Honor Pengelola Web	60,000,000	70,000,000	80,000,000
Biaya Lisensi Software	50,000,000	60,000,000	70,000,000
Hardware upgrades	100,000,000	100,000,000	100,000,000
Biaya Komunikasi	20,000,000	30,000,000	40,000,000
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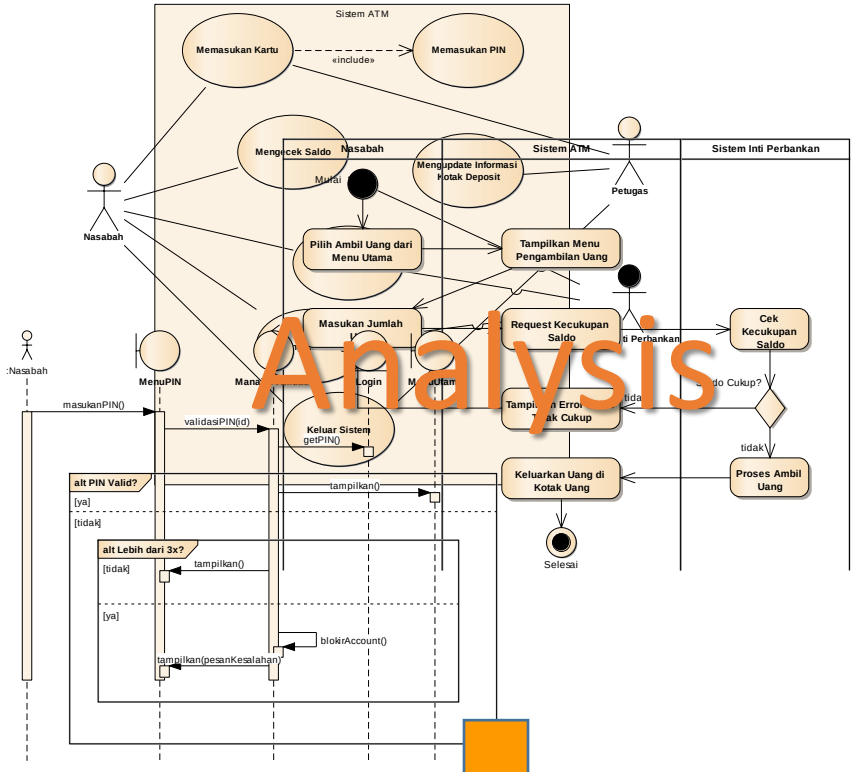
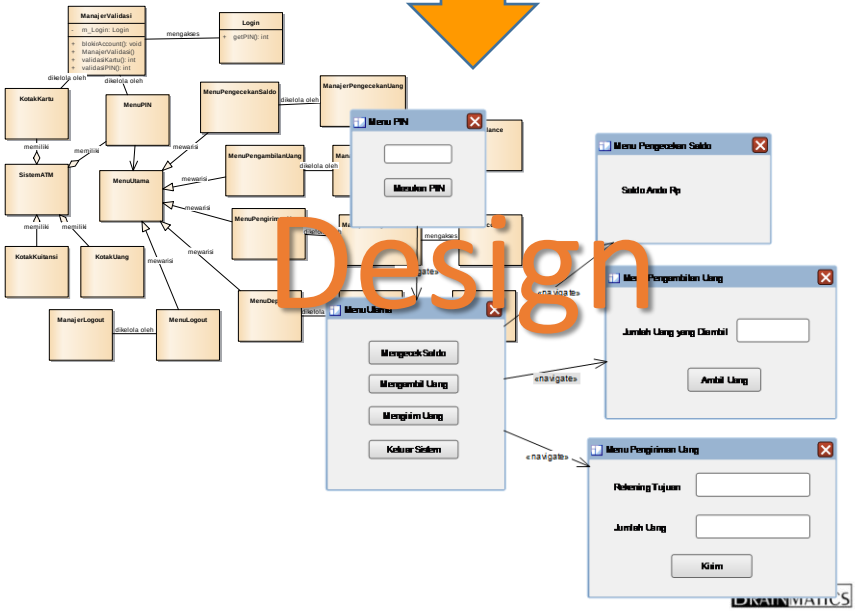
Total Operational Costs:	**330,000,000**	**460,000,000**	**590,000,000**
Total Costs:	**780,000,000**	**460,000,000**	**590,000,000**
PV of Costs:	**735,849,057**	**409,398,362**	**495,375,377**
PV of all Costs:	**735,849,057**	**1,145,247,419**	**1,640,622,796**
Total Project Costs Less Benefits:	**-780,000,000**	**640,000,000**	**710,000,000**
Yearly NPV:	**-735,849,057**	**569,507,722**	**596,129,691**
Cumulative NPV:	**-735,849,057**	**-166,251,335**	**429,878,356**
Return on Investment (ROI) di Tahun 3: 26.2%	**429,878,356/1,640,622,796**		**0.262021445**
Break-even Point (BEP): 2.28 tahun	**2 + (596,129,691-429,878,356)/ 596,129,691**		**2.278884507**

Analysis



Design



Implementation

System Request: Sistem Penjualan Musik Online

Project Sponsor: Margaret Mooney, Vice President of Marketing

Business Needs: Project ini dibangun untuk:

1. Mendapatkan pelanggan baru lewat Internet

Business Requirement

Sistem yang mendukung

1. Fitur Pencarian Pro
2. Fitur Pencarian Tok
3. Fitur Pemesanan Pr
4. Fi

Studi Kelayakan Sistem Penjualan Musik Online

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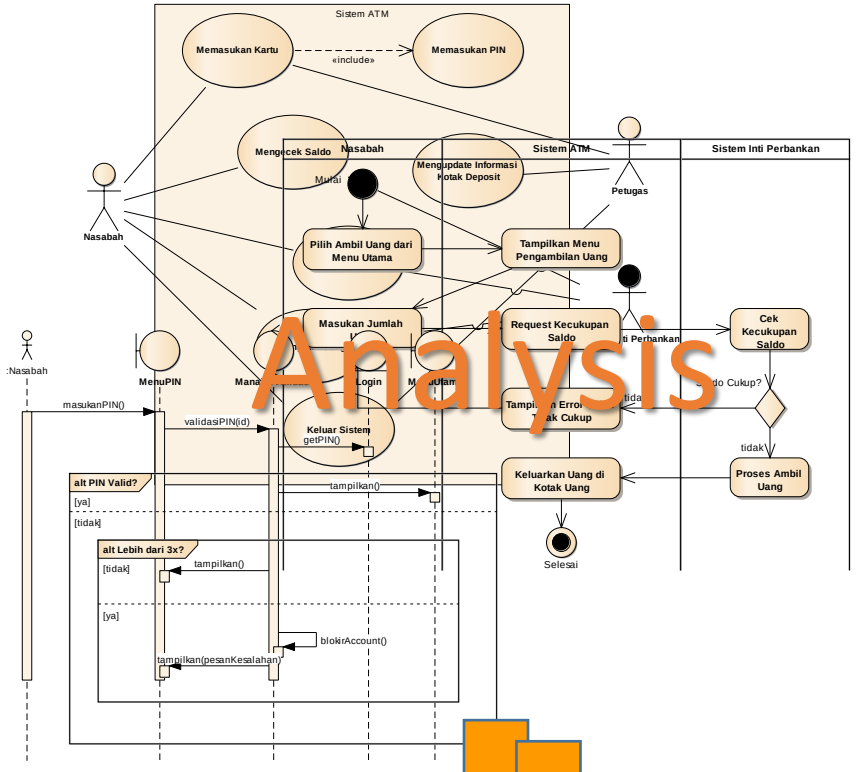
Planning

Analysis

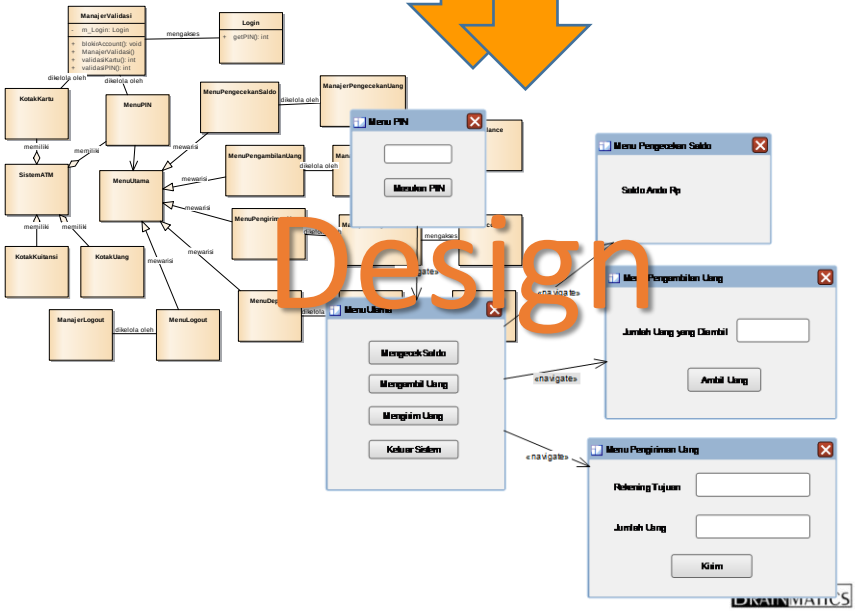


Versi 1

Versi 2

Implementation

Design



System Request: Sistem Penjualan Musik Online

Project Sponsor:	Margaret Mooney, Vice President of Marketing
Business Needs:	Project ini dibangun untuk:
	1. Mendapatkan pelanggan baru lewat Internet
	2. M

Business Requirement
Sistem yang menduku
1. Fitur Pencarian Pro
2. Fitur Pencarian Tok
3. Fitur Pemesanan Pr
4. Fi

Busi
Intar

Tang

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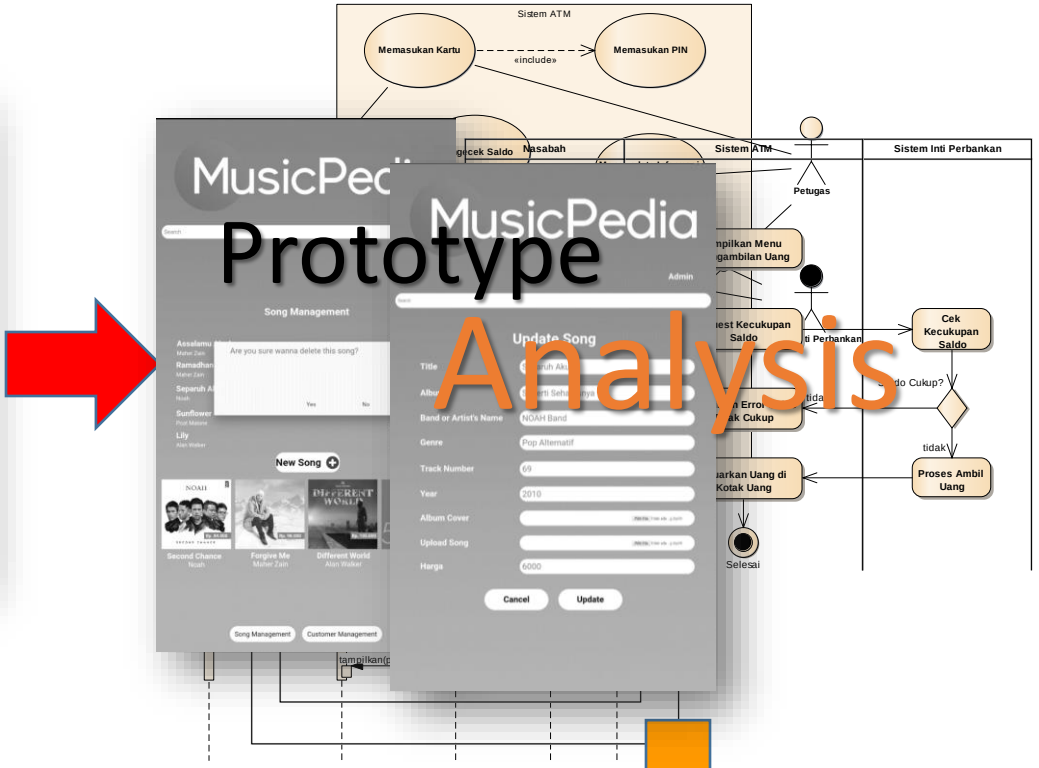
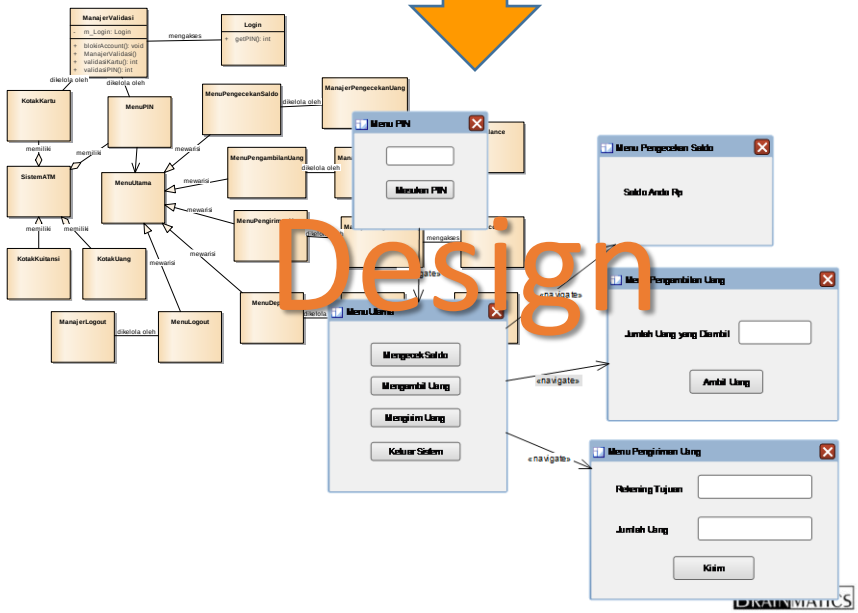
Planning



Prototype

Analysis

Implementation



Design

System Request: Sistem Penjualan Musik Online

Project Sponsor: Margaret Mooney, Vice President of Marketing

Business Needs: Project ini dibangun untuk:

1. Mendapatkan pelanggan baru lewat Internet

Studi Kelayakan Sistem Penjualan Musik Online

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Planning

Sprint 1

Analysis

Sprint 2

Hasil Sprint 1

Hasil Sprint 2

Implementation

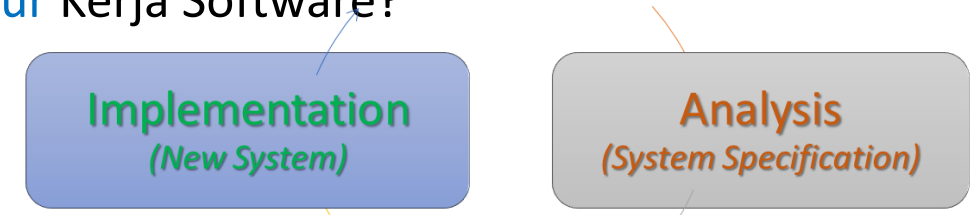
Design

1.2 System Request dan Feasibility Analysis

Siklus Pengembangan Software

1. **Planning**: Mengapa Software harus Dikembangkan?
   - System request
   - Feasibility Analysis (project size estimation)

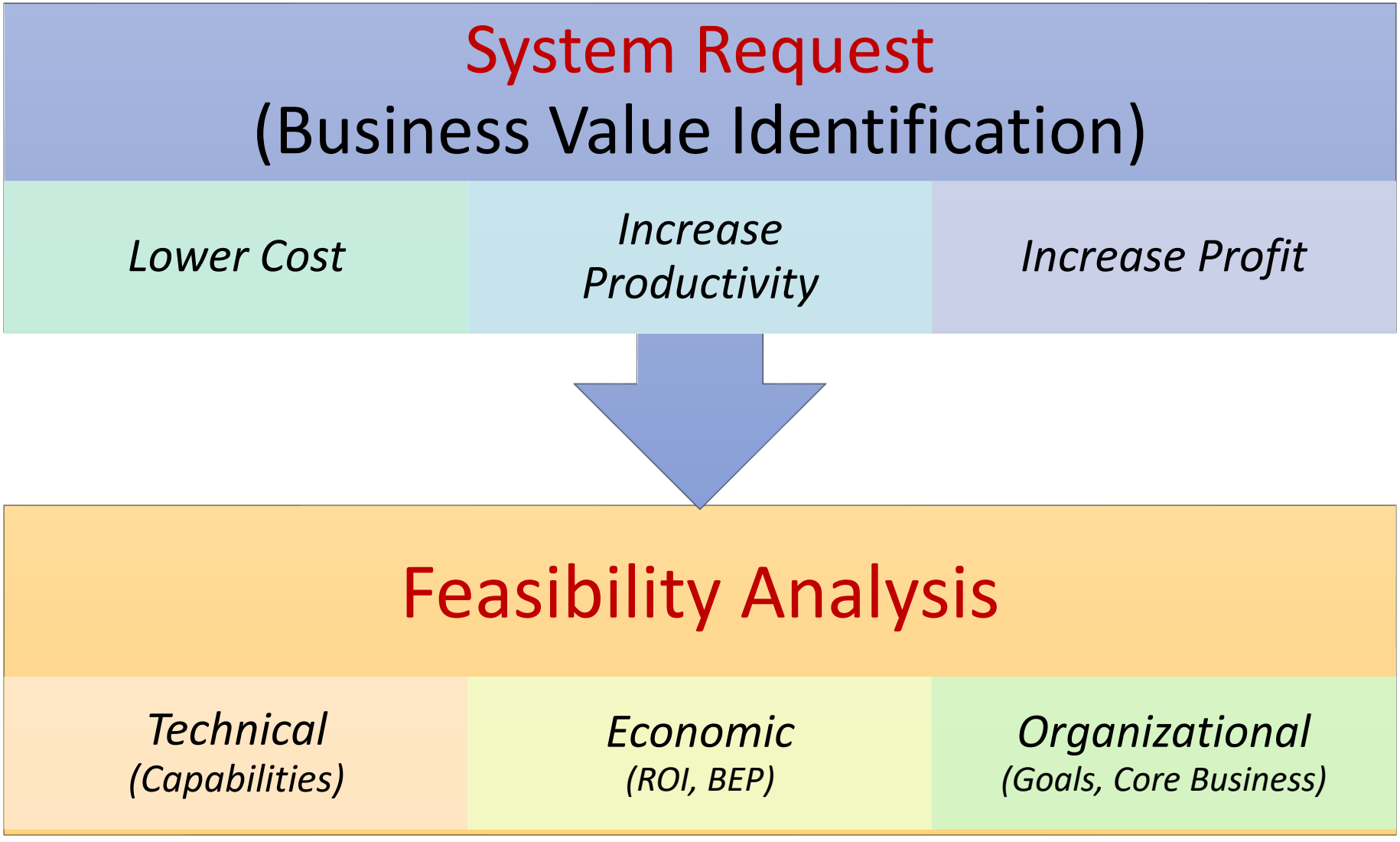
2. **Analysis**: Siapa Pengguna dan Alur Kerja Software?
   - Requirement gathering
   - Business process modeling



3. **Design**: Bagaimana Komposisi dari Software?
   - Program design
   - User interface design
   - Data design

4. **Implementation**: Konstruksi dan Penyerahan Software
   - System construction
   - Testing
   - Documentation
   - Installation

Planning



System Request

Elemen	Deskripsi	Contoh
Business Need	• The business-related reason for initiating the software development project • Reason prompting the project, and why the project should be funded?	• Meningkatkan penjualan • Mengurangi biaya operasional • Meningkatkan produktifitas pegawai • Meningkatkan kualitas layanan • Mengurangi kebocoran/kecurangan • Mengurangi cacat produksi • Meningkatkan efisiensi kerja
Business Value	• The benefits that the software will create for the organization • Tangible value (a quantiable value) and intangible value (intuitive believe)	• Peningkatan penjualan 3% • Pengurangan biaya operasional 10% • Peningkatan produktifitas pegawai 10% (dihitung rasio pekerjaan dan gaji) • Pengurangan cacat produksi 20% • Peningkatan efisiensi kerja 20%
Business Requirements	• The business capabilities that software will provide • Can be replaced by Use Case Diagram	• Fitur registrasi, login, dan logout • Fitur pengelolaan data pengguna • Fitur pengiriman notifikasi otomatis • Fitur cetak laporan bulanan dan tahunan

Software Berkualitas?

Software quality is *(IEEE, 1991)*:

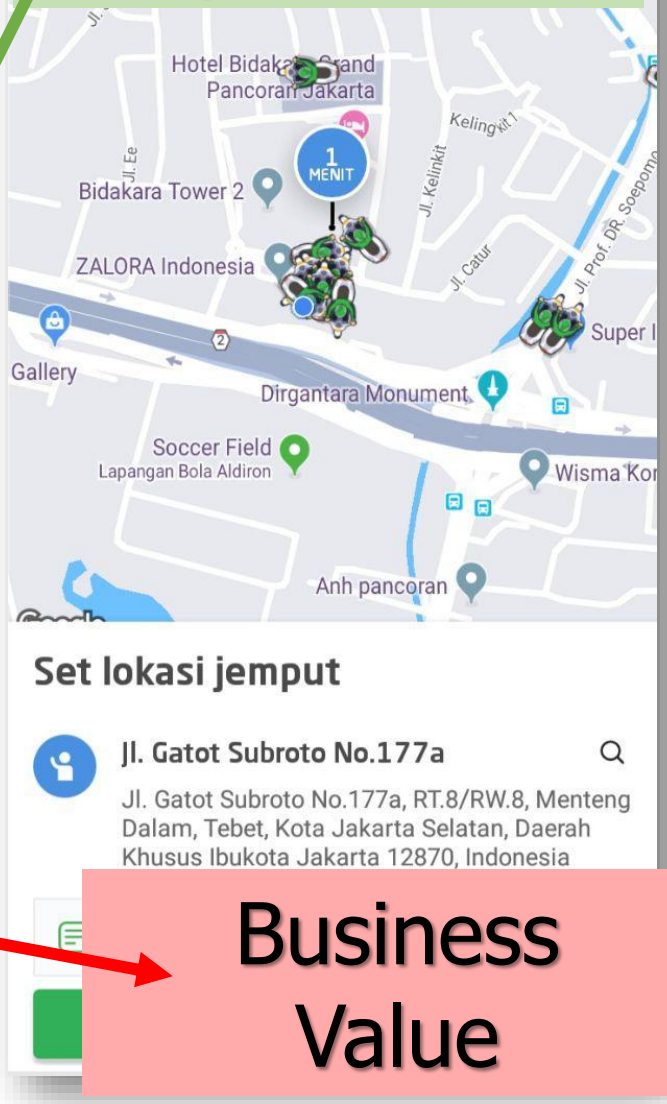
1. The degree to which a system, component, or

Sesuai Kebutuhan

2. The degree to which a system, component, or process meets customer

Ada Keuntungan

Business Requirements



Business Value

System Request: Sistem Penjualan Musik Online

Project Sponsor: Margaret Mooney, Vice President of Marketing

Business Needs: Project ini dibangun untuk:

1. Mendapatkan pelanggan baru lewat Internet
2. Meningkatkan efisiensi penanganan masalah pelanggan melalui internet

Business Requirements:

Sistem yang mendukung penjualan musik secara online. Fitur-fitur yang harus ada:

1. Fitur Pencarian Produk
2. Fitur Pencarian Toko yang Menyediakan Stok Produk
3. Fitur Pemesanan Produk Melalui Toko yang Menyediakan
4. Fitur Pembayaran dengan Berbagai Pilihan Pembayaran

Business Value:

Intangible Value:

- Meningkatkan kenyamanan dan kepuasan pelanggan
- Meningkatkan brand recognition tentang perusahaan di dunia Internet

Tangible Value:

1. Meningkatkan penjualan dari pelanggan baru lewat Internet:
   - Rp 400 juta peningkatan penjualan dari pelanggan baru dan Rp 600 juta dari pelanggan lama
2. Mengurangi biaya operasional untuk menangani komplain dari pelanggan
   - Rp 100 juta pengurangan tahunan biaya telepon untuk menangani pelanggan

Studi Kelayakan Sistem Penjualan Musik Online

Margaret Mooney dan Alec Adams membuat studi kelayakan untuk pengembangan Sistem Penjualan Musik Online

Kelayakan Teknis

Sistem penjualan musik online layak secara teknis, meskipun memiliki beberapa risiko.

Risiko Berhubungan dengan **Kefamilieran dengan Aplikasi**: Resiko Tinggi

- Divisi Marketing tidak memiliki pengalaman menggunakan sistem penjualan online
- Divisi IT memiliki pemahaman yang baik tentang sistem penjualan offline, akan tetapi tidak berpengalaman mengembangkan sistem penjualan musik online

Risiko Berhubungan dengan **Kefamilieran dengan Teknologi**: Resiko Sedang

- Divisi IT tidak menguasai masalah infrastruktur dan ISP, tetapi akan menyewa konsultan
- Divisi IT cukup familier dengan framework dan IDE yang akan digunakan
- Divisi Marketing tidak memiliki pengalaman menggunakan teknologi Web

Risiko berhubungan dengan **Ukuran Project**: Risiko Rendah

- Perusahaan memiliki total 30 orang pengembang
- Project dikerjakan oleh 5 orang pengembang dengan estimasi waktu 6 bulan

Kompatibilitas dengan sistem dan infrastruktur yang ada: Risiko Rendah

- Sistem pemesanan yang ada sekarang menggunakan *open standard*, jadi sangat kompatibel dengan sistem penjualan berbasis web yang akan dibangun

Kelayakan Ekonomi

Cost benefit analysis telah dilakukan. Sistem Penjualan musik online memiliki peluang yang baik untuk bisa meningkatkan pendapatan perusahaan.

- Return on Investment (ROI) setelah 3 tahun: **31%**
- Break-even point (BEP): **2.25 tahun**
- Total keuntungan setelah 3 tahun: **Rp. 503.559.986,-**

Kelayakan Organisasi

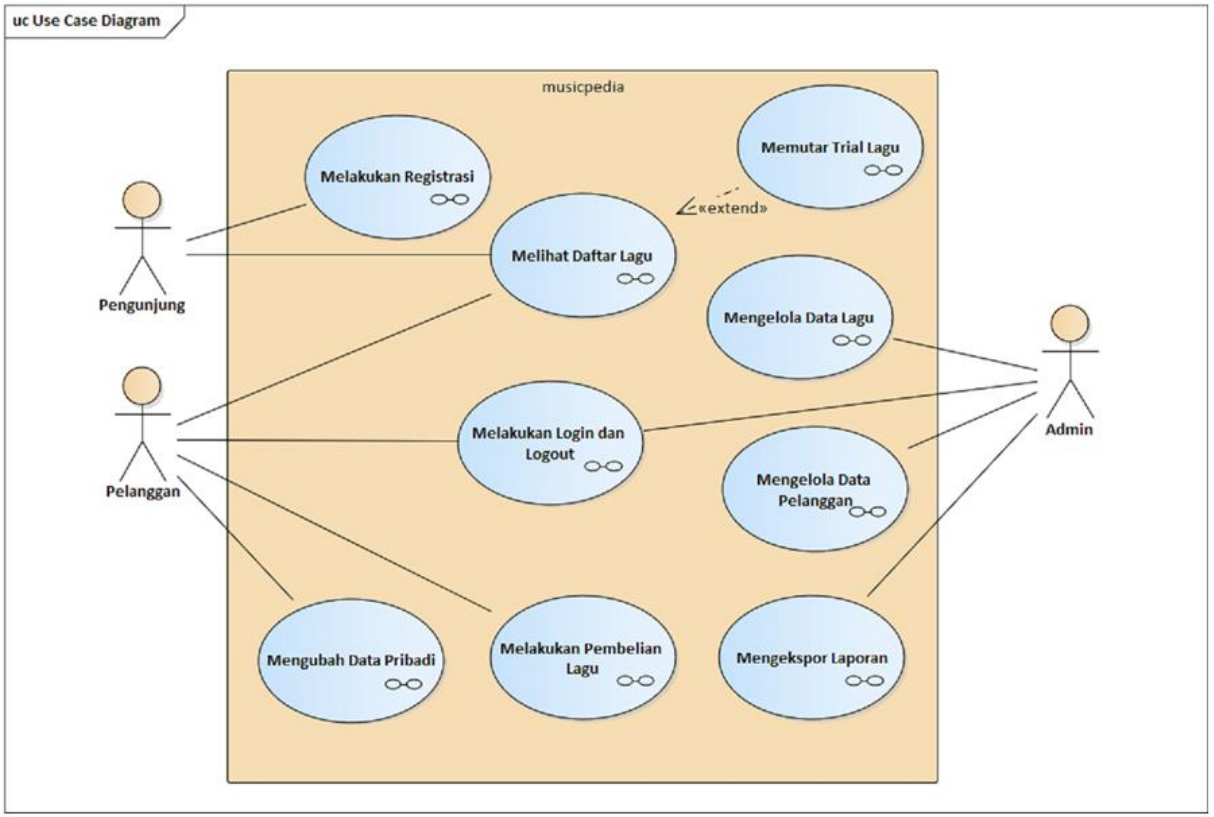
- Secara organisasi, resikonya rendah. Tujuan dari pengembangan sistem penjualan musik online adalah meningkatkan penjualan perusahaan. Dan ini selaras dengan KPI marketing yang ke arah peningkatan kuantitas penjualan
- Project champion dari pengembangan sistem penjualan musik online ini adalah Margaret Mooney, Vice President of Marketing

	2019	2020	2021
Peningkatan penjualan dari pelanggan baru	0	400,000,000	500,000,000
Peningkatan penjualan dari pelanggan lama	0	600,000,000	700,000,000
Pengurangan biaya operasional dan telepon	0	100,000,000	100,000,000
Total Benefits:	**0**	**1,100,000,000**	**1,300,000,000**
PV of Benefits:	**0**	**978,996,084**	**1,091,505,068**
PV of All Benefits:	**0**	**978,996,084**	**2,070,501,152**
Honor Tim (Analysis, Design and Implementation)	360,000,000	0	0
Honor Konsultan	90,000,000	0	0
Total Development Costs:	**450,000,000**	**0**	**0**
Honor Pengelola Web	60,000,000	70,000,000	80,000,000
Biaya Lisensi Software	50,000,000	60,000,000	70,000,000
Hardware upgrades	100,000,000	100,000,000	100,000,000
Biaya Komunikasi	20,000,000	30,000,000	40,000,000
Biaya Marketing	100,000,000	200,000,000	300,000,000
Total Operational Costs:	**330,000,000**	**460,000,000**	**590,000,000**
Total Costs:	**780,000,000**	**460,000,000**	**590,000,000**
PV of Costs:	**735,849,057**	**409,398,362**	**495,375,377**
PV of all Costs:	**735,849,057**	**1,145,247,419**	**1,640,622,796**
Total Project Costs Less Benefits:	**-780,000,000**	**640,000,000**	**710,000,000**
Yearly NPV:	**-735,849,057**	**569,597,722**	**669,811,321**
Cumulative NPV:	**-735,849,057**	**-166,251,335**	**503,559,986**
Return on Investment (ROI) di Tahun 3: 30.70%	**-100.00%**	**-0.145166304**	**0.306932213**
Break-even Point (BEP): 2.25 tahun			**2.248206218**

Software Request

musicpedia				
Date	26 Oktober 2018			
Description	Musicpedia adalah aplikasi layanan download musik & audio dimana saja dan kapan saja, menawarkan akses lengkap ke jutaan lagu dari semua artis papan atas di industri musik barat maupun musik lokal, mendengarkan musik baru dan top musik dunia dalam bentuk audio mp3 secara offline			
Project Sponsor	Wahyu Utomo, VP Business Development, PT Musika Indonesia			
Business Need	1. Tidak Setuju	2. Ragu-Ragu	3. Setuju	4. Sangat Setuju
Aplikasi yang dikembangkan mampu meningkatkan pendapatan perusahaan?	☐	☐	☐	☑
Aplikasi yang dikembangkan mampu mengurangi biaya operasional perusahaan?	☐	☐	☑	☐
Aplikasi yang dikembangkan mampu meningkatkan produktifitas kerja pegawai?	☐	☑	☐	☐
Aplikasi yang dikembangkan mampu meningkatkan nilai tambah perusahaan yang bersifat intangible?	☐	☐	☑	☐
Business Value	Intangible Value: a. Meningkatkan brand recognition perusahaan di dunia internet b. Meningkatkan produktivitas kerja pegawai dan mengurangi kuantitas pegawai Tangible Value: a. Mengurangi biaya operasional perusahaan: - Sewa ruangan: Rp120.000.000,- - Biaya komunikasi: Rp6.000.000,- b. Meningkatkan penjualan musik: Rp400.000.000,-			

Business Requirements



Technical Feasibility

musicpedia				
Date: 26 Oktober 2018				
Penjelasan isian	1. Sangat Kurang	2. Kurang	3. Baik	4. Sangat Baik

Kefamiliaran dengan Aplikasi	1	2	3	4
Pengguna familiar terhadap pengoperasian aplikasi ini.	☐	☐	☑	☐
Pengembang familiar terhadap pengembangan aplikasi ini.	☐	☐	☐	☑
Kefamiliaran dengan Teknologi	**1**	**2**	**3**	**4**
Pengguna familiar dengan teknologi pendukung aplikasi.	☐	☑	☐	☐
Pengembang familiar mengembangkan aplikasi dengan platform, bahasa pemrograman dan tool IDE yang dipilih.	☐	☐	☐	☑
Ukuran Proyek				
Jumlah pengembang yang dibutuhkan.	7 Man/Month			
Waktu yang dibutuhkan dalam mengembangkan aplikasi ini.	6 Month			
Kompatibilitas	**1**	**2**	**3**	**4**
Kebutuhan pengguna terhadap kompatibilitas aplikasi untuk terintegrasi dengan aplikasi lain.	☐	☐	☑	☐
Kompatibilitas aplikasi terhadap teknologi yang ada pada organisasi.	☐	☐	☐	☑

Secara analisi kelayakan teknis, apakah aplikasi layak dikembangkan sesuai kriteria di atas?	☑ Layak	☐ Tidak Layak

Technical Feasibility

Use Case Points

Tahap 1 - Menghitung Person Hours (PH)				
Use Case Points (UCP)		Person Hours Multiplier (PHM)	Person Hours (PH)	
51		20	1020	
51		28	1428	
Tahap 2 - Menghitung Person Month (PM)				
PHM	Person Hours (PH)	Lama Bekerja Perhari	Jumlah Bekerja Sebulan	Person Months (PM)
20	1020	8	22	5.80
	1020	10	26	3.92
28	1428	8	22	8.11
	1428	10	26	5.49
Tahap 3 - Menghitung Time (Month)				
PHM	Formula Penghitung Waktu		Jumlah Bekerja Sebulan	Waktu dalam Bulan (M)
20	3 * PM^(1/3)		22	5.39
			26	4.73
28			22	6.03
			26	5.29

Economic Feasibility

Cost-Benefit Analysis

Tahun	2019	2020	2021	2022
Peningkatan Pendapatan Penjualan Lagu		400,000,000	400,000,000	400,000,000
Pengurangan Biaya Sewa Ruangan		120,000,000	120,000,000	120,000,000
Pengurangan Biaya Komunikasi		6,000,000	6,000,000	6,000,000
Total Benefits	**0**	**526,000,000**	**526,000,000**	**526,000,000**
PV of Benefits	**0**	**468,138,127**	**441,639,743**	**416,641,267**
PV of All Benefits	**0**	**468,138,127**	**909,777,870**	**884,779,394**
Honor Tim (Analysis, Design and Implementation)	250,000,000	120,000,000	120,000,000	120,000,000
Total Development Costs	**250,000,000**	**120,000,000**	**120,000,000**	**120,000,000**
Honor Pengelola Web	72,000,000	72,000,000	72,000,000	72,000,000
Biaya Lisensi Software	10,000,000	10,000,000	10,000,000	10,000,000
Hardware upgrades	50,000,000	50,000,000	50,000,000	50,000,000
Biaya Komunikasi	1,000,000	1,000,000	1,000,000	1,000,000
Biaya Marketing	50,000,000	50,000,000	50,000,000	50,000,000
Total Operational Costs	**183,000,000**	**183,000,000**	**183,000,000**	**183,000,000**
Total Costs	**433,000,000**	**303,000,000**	**303,000,000**	**303,000,000**
PV of Costs	**408,490,566**	**269,668,921**	**153,650,329**	**144,953,140**
PV of all Costs	**408,490,566**	**678,159,487**	**831,809,816**	**976,762,957**
Total Project Costs Less Benefits	**-433,000,000**	**223,000,000**	**223,000,000**	**223,000,000**
Yearly NPV	**-408,490,566**	**198,469,206**	**187,235,100**	**176,636,887**
Cumulative NPV	**-408,490,566**	**-210,021,360**	**-22,786,260**	**153,850,627**
Return on Investment (ROI)	**-100.00%**	**-0.309693168**	**-0.027393593**	**0.15751071**
Break-even Point (BEP)				**3.129000574**

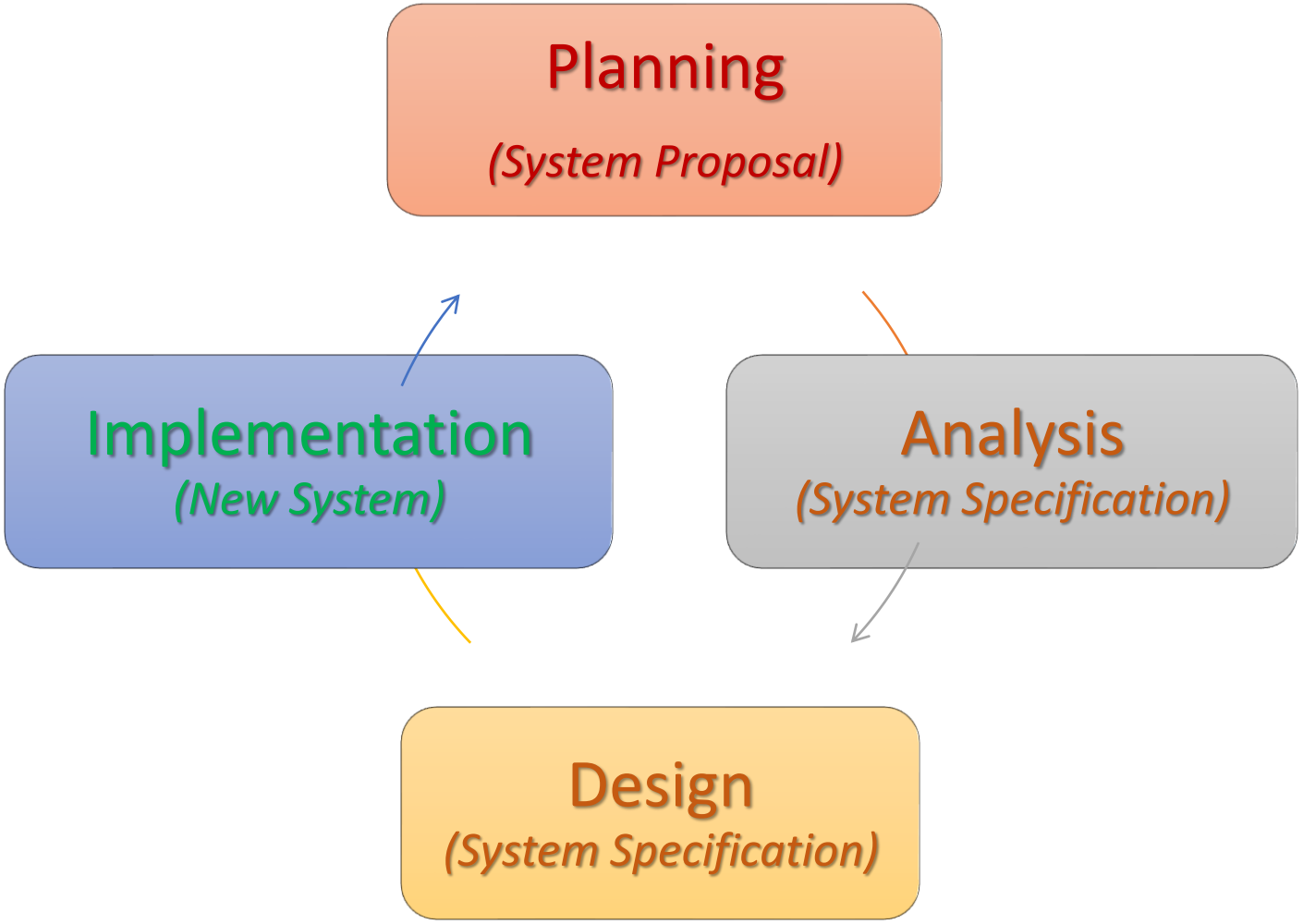
Organizational Feasibility

musicpedia			
Date	**26 Oktober 2018**		
Anggota Tim			
User/Product Owner	Wahyu Utomo		
Project Manager	Haris Dermawan		
System Analyst	Risa Dhani Horasman Purba		
Business Analyst	Mulyana		
Programmer	Achmad Fatkarrofiqi		
Tester	Januar Sapareza		
Apakah aplikasi ini mendukung visi dan misi organisasi?			
Ya			
Apakah aplikasi ini sesuai dengan tugas, fungsi dan KPI unit kerja anda?			
Ya			
Apakah aplikasi ini selaras dengan proses bisnis unit kerja anda?			
Ya			
Secara analisis kelayakan organisasi, apakah aplikasi layak dikembangkan sesuai kriteria di atas?		☑ Layak	☐ Tidak Layak

2. Systems Analysis

2.1 Requirement Gathering

Siklus Pengembangan Software



(Tilley, 2012) *(Dennis, 2016)* *(Valacich, 2017)*

Boehm's First Law

Errors are most frequent during the requirements and design activities, and are the more expensive the later they are removed

(Endres, 2003) *[L2]*

What is a Requirements

- Business Requirements
  - Statement of what the system must do
  - Focus on what the system must do, not how to do it
- There are 2 kinds of requirements
  1. Functional Requirements
  2. Nonfunctional Requirements

D. Nonfunctional Requirements

1. Operational Requirements
1.1. The system will operate in Windows and Macintosh environments
1.2. The system will be able to read and write Word documents, RTF, and HTML
1.3. The system will be able to import Gif, Jpeg, and BMP graphics files

2. Performance Requirements
2.1. Response times must be less than 7 seconds
2.2. The Inventory database must be updated in real time

3. Security Requirements
3.1. No special security requirements are anticipated

4. Cultural and Political Requirements
4.1. No special cultural and political requirements are anticipated

C. Functional Requirements

1. Printing
1.1. The user can select which pages to print
1.2. The user can view a preview of the pages before printing
1.3. The user can change the margins, paper size (e.g., letter, A4) and orientation on the page

2. Spell Checking
2.1. The user can check for spelling mistakes; the system can operate in one of two modes as selected by the users
2.1.1. Mode 1 (Manual): The user will activate the spell checker and it will move the user to the next misspelled word
2.1.2. Mode 2 (Automatic): As the user types, the spell checker will flag misspelled words so the user immediately see the misspelling
2.2. The user can add words to the dictionary
2.3. The user can mark words as not misspelled but not add them to the dictionary

Contoh Template System Specification (SRS, BRD, FSD)

1. System Planning
   - 1.1 Project Scope
   - 1.2 Project Schedule
   - 1.3 Project Team
2. System Design
   - 2.1 Functional Requirements
     - 2.1.1 Actor
     - 2.1.2 Use Case Diagram
     - 2.1.3 Activity Diagram (BPMN)
     - 2.1.4 Sequence Diagram
     - 2.1.5 Class Diagram
     - 2.1.6 Data Model
     - 2.1.7 User Interface Design
     - 2.1.8 Deployment Diagram
     - 2.1.9 Relational Matrices
       - 2.1.9.1 Actor – Activity Diagram
       - 2.1.9.2 Actor – Sequence Diagram
   - 2.2 Nonfunctional Requirements
     - 2.2.1 Operational
     - 2.2.2 Performance
     - 2.2.3 Security
     - 2.2.4 Hardware
     - 2.2.5 Development Platform
     - 2.2.6 Deadline
3. System Implementation
   - 3.1 Testing Strategy
   - 3.2 Installation Strategy
   - 3.3 Change Management Strategy

1. Functional Requirement

- Kebutuhan tentang fungsi software secara menyeluruh
- Pemodelan dengan UML, ataupun penjelasan fitur-fitur dalam bentuk problem statements, adalah termasuk dalam Functional Requirement
  - Diagrams:
    - Use Case Diagrams
    - Activity Diagrams
  - Problem Statements:
    - Must search for inventory
    - Must perform these calculations
    - Must produce a specific report

2. Nonfunctional Requirements

1. Operational – Physical/technical environment
2. Performance – Speed and reliability
3. Security – Who can use the system
4. Cultural & Political – Company policies, legal issues

Nonfunctional Requirements

Jaringan Dokumentasi dan Informasi Hukum (JDIH)

Date: 23 Oktober 2018

Operational Requirements

1. Sistem dapat digunakan oleh semua perangkat lunak yang lainnya.
2. Sistem layanan harus memiliki tingkat ketersediaan 99%.
3. System harus go live sebelum tanggal 25 Januari 2018.

Performance Requirements

1. Waktu respon harus tidak lebih dari 2 detik.
2. Mampu diakses oleh lebih dari 50 pengguna secara bersamaan.
3. Server harus bersih dari virus.

Security Requirements

1. Akses ke dalam system tanpa otorisasi tidak dimungkinkan.
2. Data hanya dapat diubah oleh administrator sistem.
3. Seluruh data harus di-backup setiap 24jam serta hasil backup-nya disimpan di lokasi yang berbeda dengan sistem.
4. Seluruh komunikasi antara client-server harus dipastikan keamanannya.

Deadline Requirements

1. Pengembangan aplikasi tidak boleh melewati jangka waktu yang sudah ditentukan.

Metode Requirement Gathering

1. Document Analysis
2. Interviews
3. Joint Application Design (JAD)
4. Questionnaires
5. Observation

1. Document Analysis

- Provides clues about the "formal" existing As-Is system
- Typical documents
  - Forms
  - Reports
  - Policy manuals
- Look for user additions to forms
- Look for unused form elements
- Do document analysis before interviews

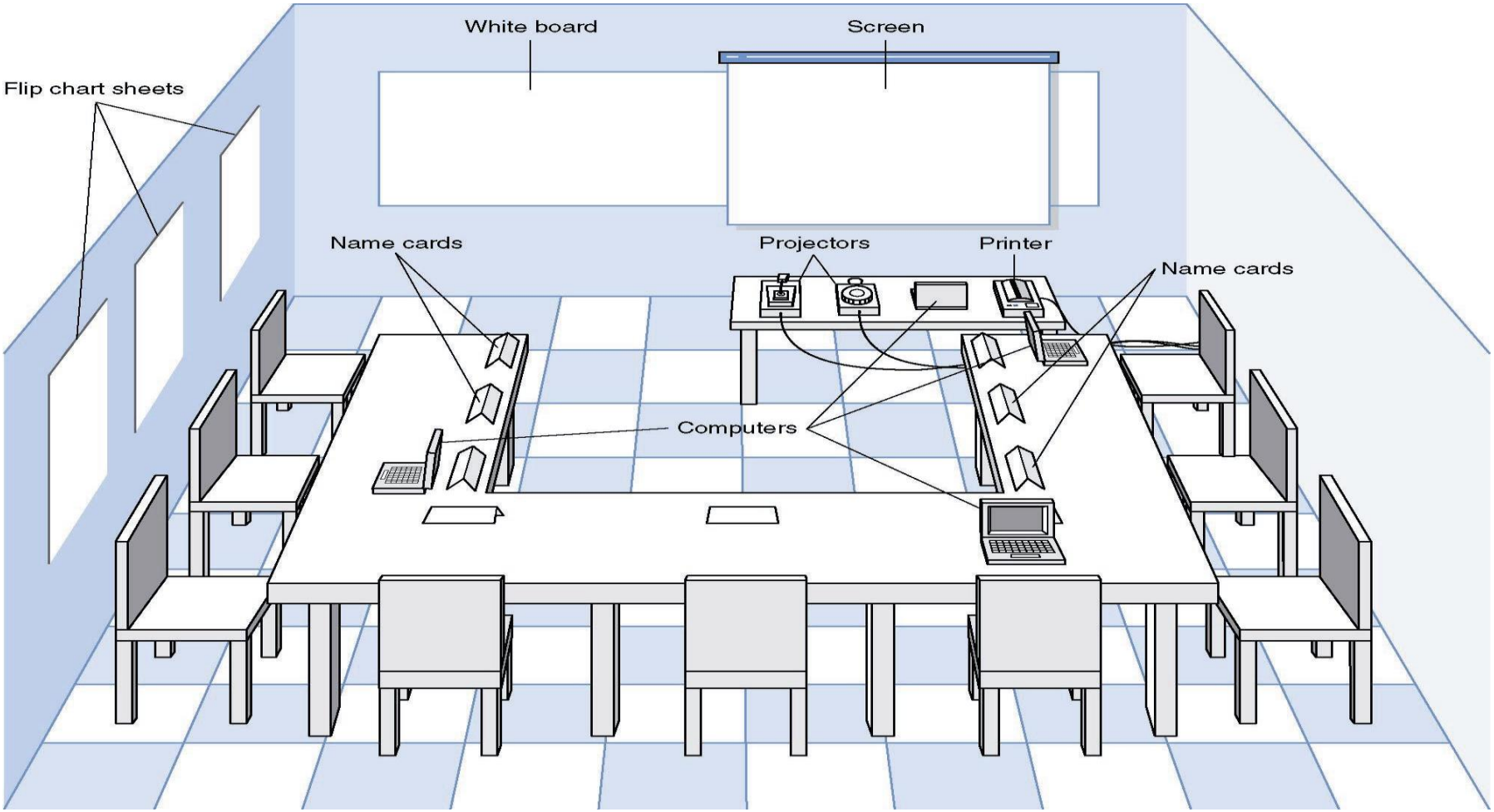
2. Interviews

- Most commonly used technique and very natural
- If you need to know something, you ask someone
- Five basic steps:
  1. Selecting interviewees
  2. Designing interview questions
  3. Preparing for the interview
  4. Conducting the interview
  5. Post-interview follow-up

3. Joint Application Design (JAD)

- Allows project managers, users, and developers to work together
- May reduce scope creep by 50%
- Avoids requirements being too specific or too vague
- Include 10 to 20 users
- Tend to last 5 to 10 days over a three-week period

JAD Meeting Room



4. Questionnaire

- Selecting participants
  - Using samples of the population
- Designing the questionnaire
  - More important than interview questions
  - Prioritize questions to grab attention
  - Distinguish between:
    1. Fact-oriented questions (specific answers)
    2. Opinion questions (agree – disagree scale)
- Administering the questionnaire
  - Explain its importance & how it will be used
  - Give expected response date
  - Follow up on late returns and have supervisors follow up
  - Promise to report results
- Questionnaire follow-up
  - Send results to participants

5. Observation

- Users/managers often don't remember everything they do
- Validates info gathered in other ways
- Behaviors change when people are watched
- Keep low profile, don't change the process
- Careful not to ignore periodic activities
  - Weekly … Monthly … Annual

Karakteristik Metode Requirement Gathering

	Interviews	JAD	Questionnaires	Document Analysis	Observation
Type of Information	As-Is Improve. To-Be	As-Is Improve. To-Be	As-Is Improve.	As-Is	As-Is
Depth of Information	High	High	Medium	Low	Low
Breadth of Information	Low	Medium	High	High	Low
Integration of Info.	Low	High	Low	Low	Low
User Involvement	Medium	High	Low	Low	Low
Cost	Medium	Low-Medium	Low	Low	Low-Medium

Business Process Analysis Strategies

1. BPA (Business Process Automation)
   - Makes almost no changes to business processes, just makes them more efficient

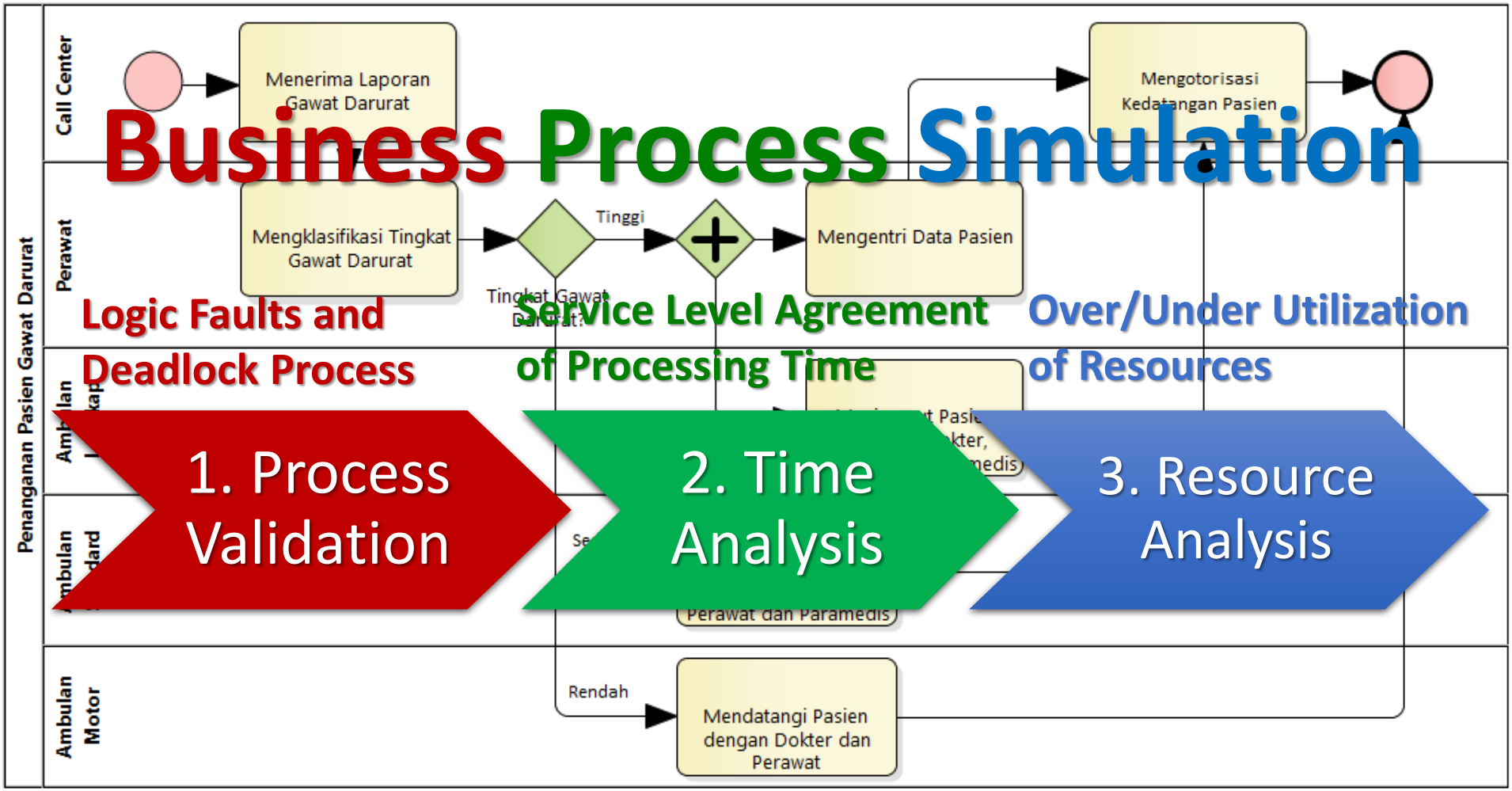
2. BPI (Business Process Improvement)
   - Change what the users do, not just how efficiently they do it

3. BPR (Business Process Reengineering)
   - Throw away everything, start with a blank page

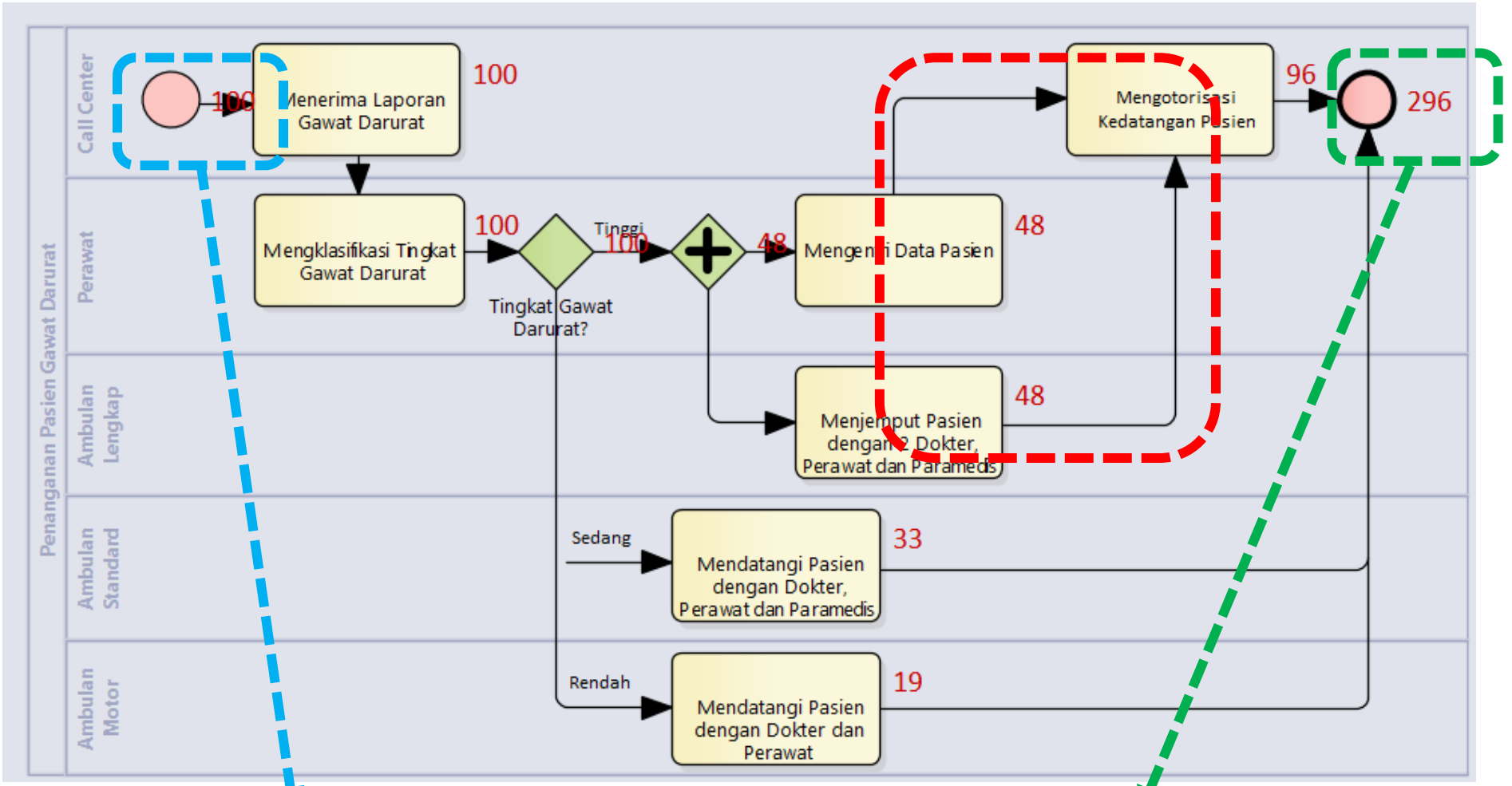
Business Process Analysis Strategies Comparison

	Business Process Automation	Business Process Improvement	Business Process Reeingineering
Potential Business Value	Low-Moderate	Moderate	High
Project Cost	Low	Low-Moderate	High
Breadth of Analysis	Narrow	Narrow-Moderate	Very Broad
Risk	Low	Low-Moderate	Very High

Business Process Simulation: Penanganan Pasien Gawat Darurat



Validasi Proses Bisnis

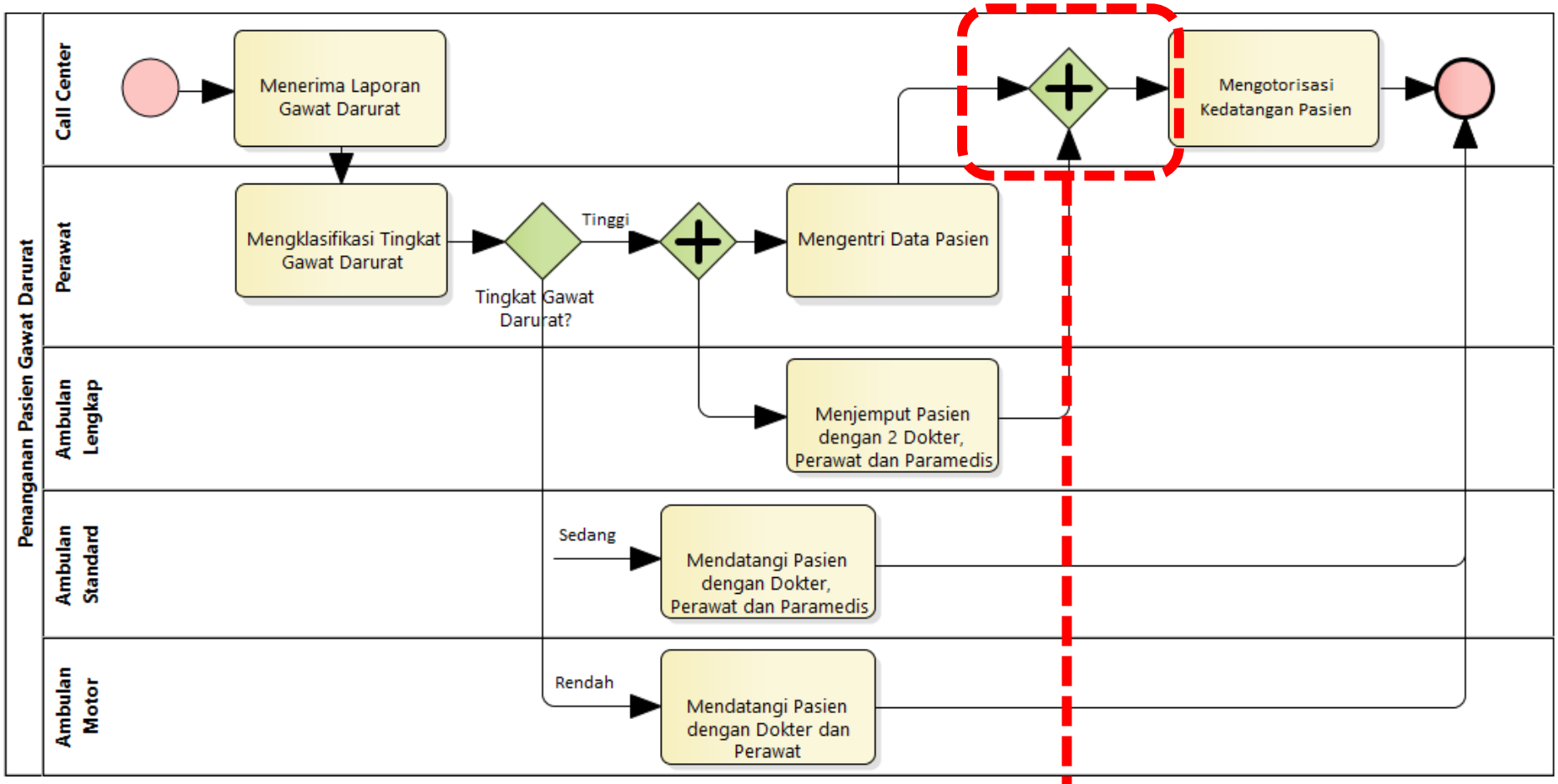


Menangani 100 Orang Pasien

Seperti Menangani 296 Orang Pasien

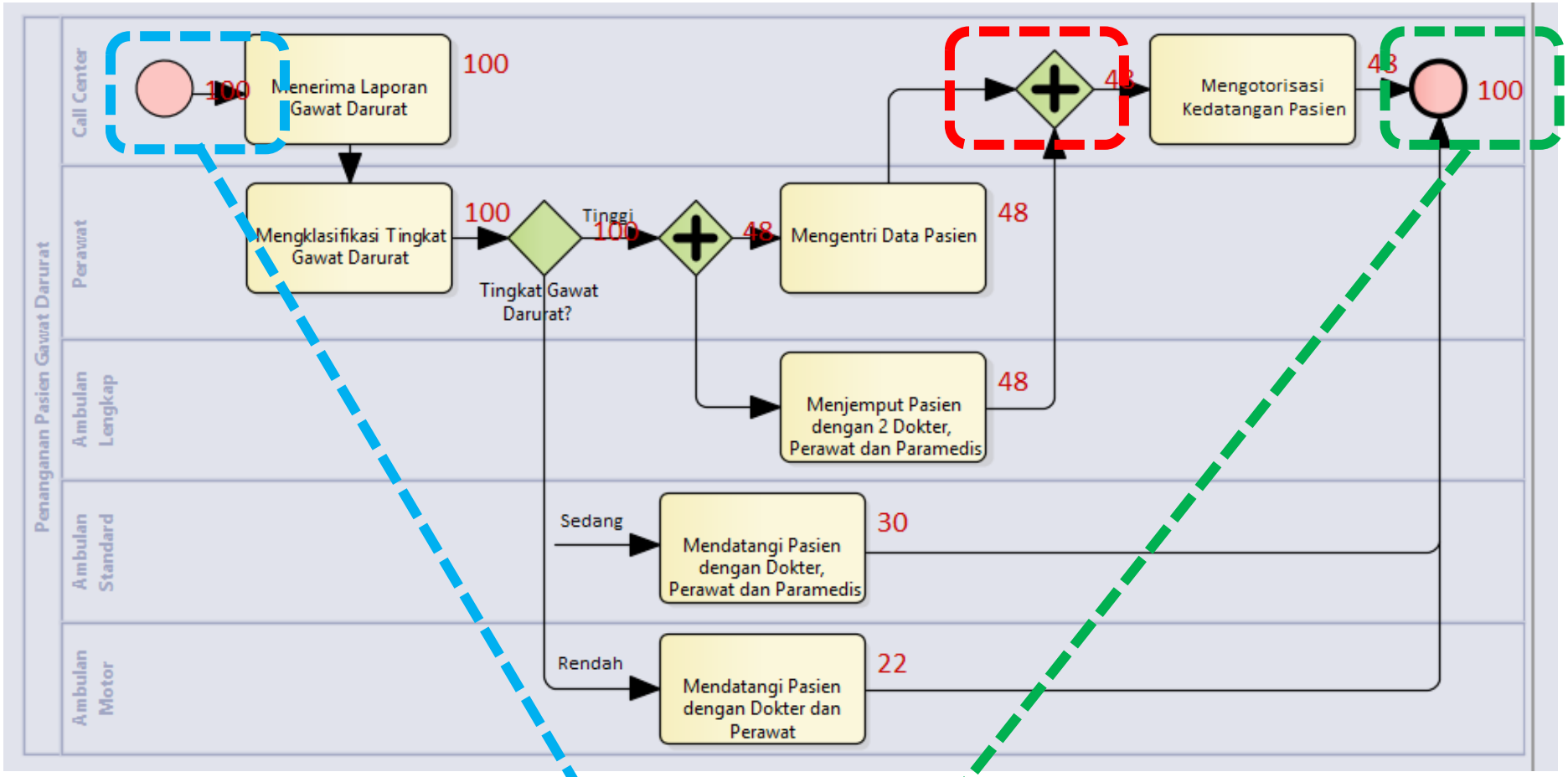
PROSES BISNIS INI TIDAK EFISIEN!

Validasi Proses Bisnis



Perlu Sinkronisasi Pekerjaan,
Sebelum Otorisasi Kedatangan Dilakukan

Validasi Proses Bisnis



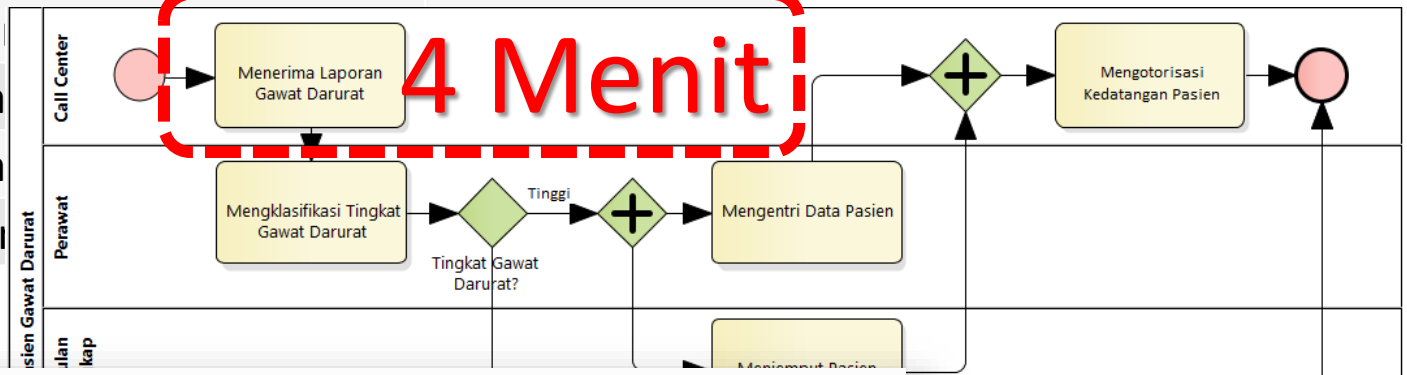
Proses Bisnis Terbukti Valid dan

100 Pasien Tertangani dengan Efisien dan Efektif!

Analisis Waktu

Aktifitas	Waktu (Menit)
Menerima Laporan Gawat Darurat	4
Mengklasifikasi Tingkat Gawat Darurat	5
Mengentri Data Pasien	11
Menjemput Pasien denga	
Mendatangi Pasien denga	
Mendatangi Pasien denga	
Mengotorisasi Kedatanga	

4 Menit

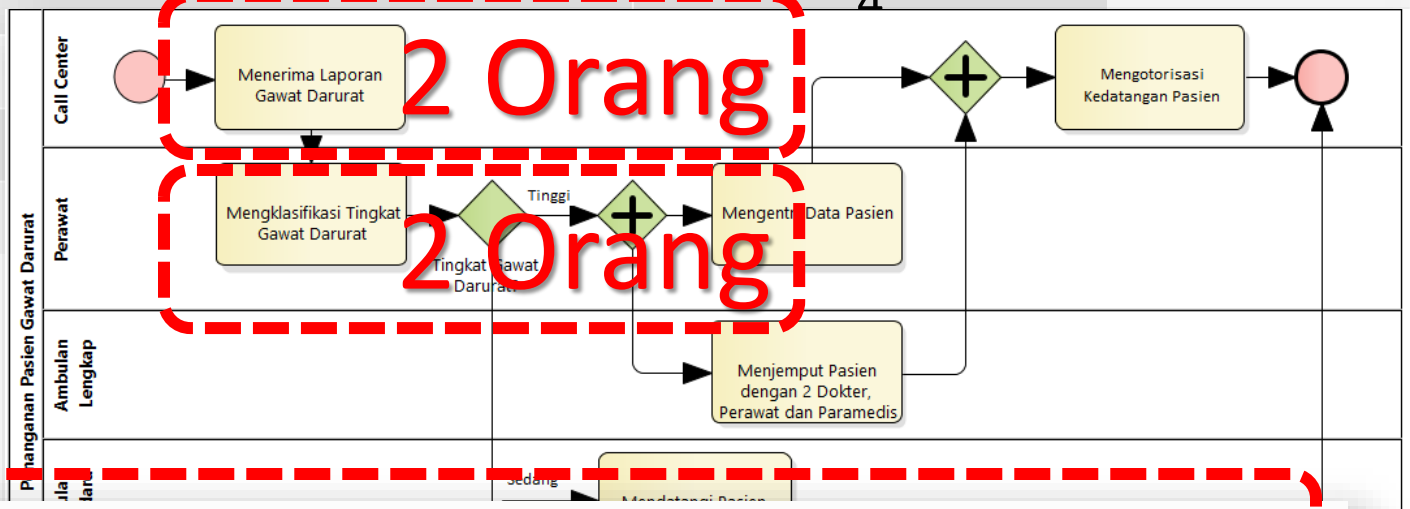


Penanganan Pasien Gawat Darurat	Average Time	249.63
Penanganan Pasien Gawat Darurat	Mean Of Processing Time	17.73
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat	Number Of Processes Started	100
Penanganan Pasien Gawat Darurat	Standard Deviation Time	131.97

Perlu Waktu 17.73 Menit untuk Menangani 1 Pasien

Analisis Sumber Daya Manusia

Sumber Daya	Kuantitas
Call center	2
Perawat	2
Ambulan Lengkap	4
Ambulan Standar	
Ambulan Motor	
Resepsionis	



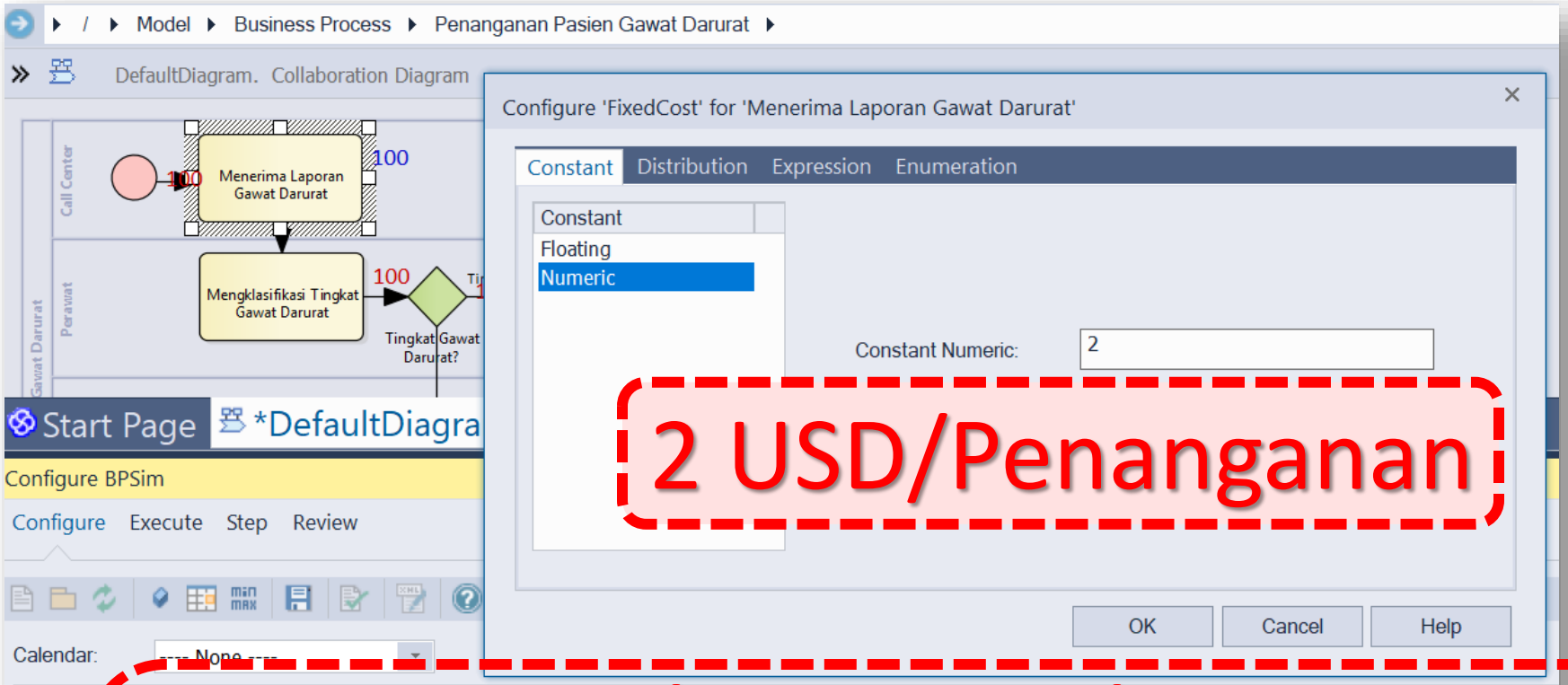
Overutilization

Perawat	Degree Of Utilisation	99%
Paramedis	Degree Of Utilisation	98.34%

Call Center	Degree Of Utilisation	65.56%
Dokter	Degree Of Utilisation	50.28%
Supir	Degree Of Utilisation	33.22%
Ambulan Standard	Degree Of Utilisation	33.22%
Ambulan Motor	Degree Of Utilisation	17.05%

Underutilization

Analisis Biaya



2 USD/Penanganan

Total Biaya Perhari

Menerima Laporan Gawat Darurat	Total Completion Cost	200
Mengentri Data Pasien	Total Completion Cost	48
Mengklasifikasi Tingkat Gawat Darurat	Total Completion Cost	100
Mengotorisasi Kedatangan Pasien	Total Completion Cost	48

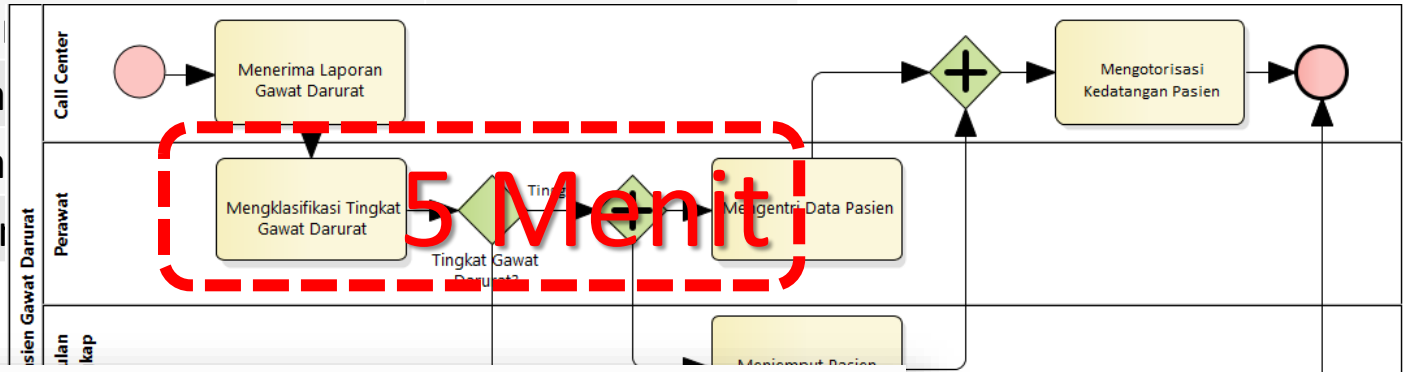
Business Process Automation

- Dikembangkan Sistem Cerdas yang membantu perawat dengan Mengautomasi Klasifikasi Tingkat Gawat Darurat

- Pekerjaan "Mengklasifikasi Tingkat Gawat Darurat" yang sebelumnya perlu waktu 5 menit
  - Dengan sistem cerdas menjadi hanya 1 menit

Business Process Simulation

Aktifitas	Waktu (Menit)
Menerima Laporan Gawat Darurat	4
Mengklasifikasi Tingkat Gawat Darurat	5
Mengentri Data Pasien	11
Menjemput Pasien denga	
Mendatangi Pasien denga	
Mendatangi Pasien denga	
Mengotorisasi Kedatanga	

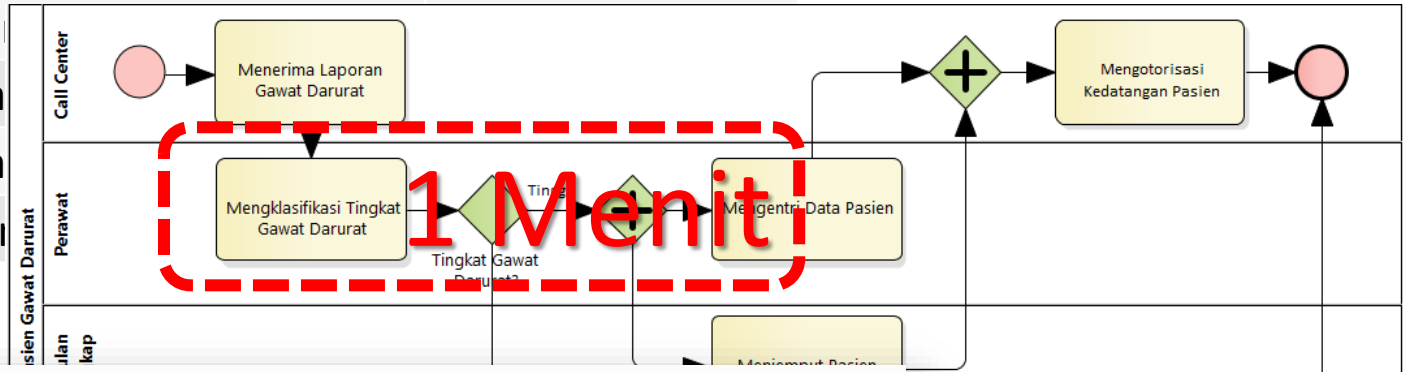


Penanganan Pasien Gawat Darurat	Average Time	249.63
Penanganan Pasien Gawat Darurat	Mean Of Processing Time	17.73
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat	Number Of Processes Started	100
Penanganan Pasien Gawat Darurat	Standard Deviation Time	131.97

Perlu Waktu 17.73 Menit untuk Menangani 1 Pasien

Business Process Automation

Aktifitas	Waktu (Menit)
Menerima Laporan Gawat Darurat	4
Mengklasifikasi Tingkat Gawat Darurat	1
Mengentri Data Pasien	11
Menjemput Pasien denga	
Mendatangi Pasien denga	
Mendatangi Pasien denga	
Mengotorisasi Kedatangai	



Penanganan Pasien Gawat Darurat	Average Time	249.63
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat		
Penanganan Pasien Gawat Darurat	Number Of Processes Completed	92
Penanganan Pasien Gawat Darurat	Number Of Processes Started	100
Penanganan Pasien Gawat Darurat	Standard Deviation Time	131.97

Hanya Perlu Waktu 8 Menit untuk Menangani 1 Pasien

Tantangan di Requirement Gathering

1. The "Yes, But" syndrome
   - Stems from human nature and the users' inability to experience the software as they might a physical device
2. The “Undiscovered Ruins”
   - Searching for requirements is like searching for "Undiscovered Ruins“
   - The more you find, the more you know remain
3. The "User and the Developer" syndrome
   - Reflects the profound differences between these two, making communication difficult

The "Yes, But" Syndrome

For whatever reason, we always see two immediate, distinct, and separate reactions when the users see the system implementation for the first time

1. "Wow, this is so cool; we can really use this, what a neat job" and so on.
2. "Yes, but, hmmmm, now that I see it, what about this ... ? Wouldn't it be nice if . . . ? Whatever happened to . . . ?“

The "Undiscovered Ruins" Syndrome

- In many ways, the search for requirements is like a search for undiscovered ruins
  - The more you find, the more you know remain
  - You never really feel that you have found them all, and perhaps you never will.

- Indeed, software development teams always struggle to determine when they are done with requirements elicitation. When have they found
  - all the requirements
  - or at least enough requirements?

The "User and the Developer" Syndrome

- Communication gap between the user and the developer

- Users and developers are
  - typically from different worlds,
  - may even speak different languages,
  - have different backgrounds,
  - have different motivations, and
  - have different objectives

The "User and the Developer" Syndrome

Reasons for this problem and some suggested solutions

Problem	Solution
Users do not know what they want, or they know what they want but cannot articulate it.	Recognize and appreciate the user as domain expert; try alternative communication and elicitation techniques.
Users think they know what they want until developers give them what they said they wanted.	Provide alternative elicitation techniques earlier: storyboarding, role playing, throwaway prototypes, and so on.
Analysts think they understand user problems better than users do.	Put the analyst in the user's place. Try role playing for an hour or a day.
Everybody believes everybody else is politically motivated.	Yes, its part of human nature, so let's get on with the program.

Evolusi Paradigma Analysis dan Design

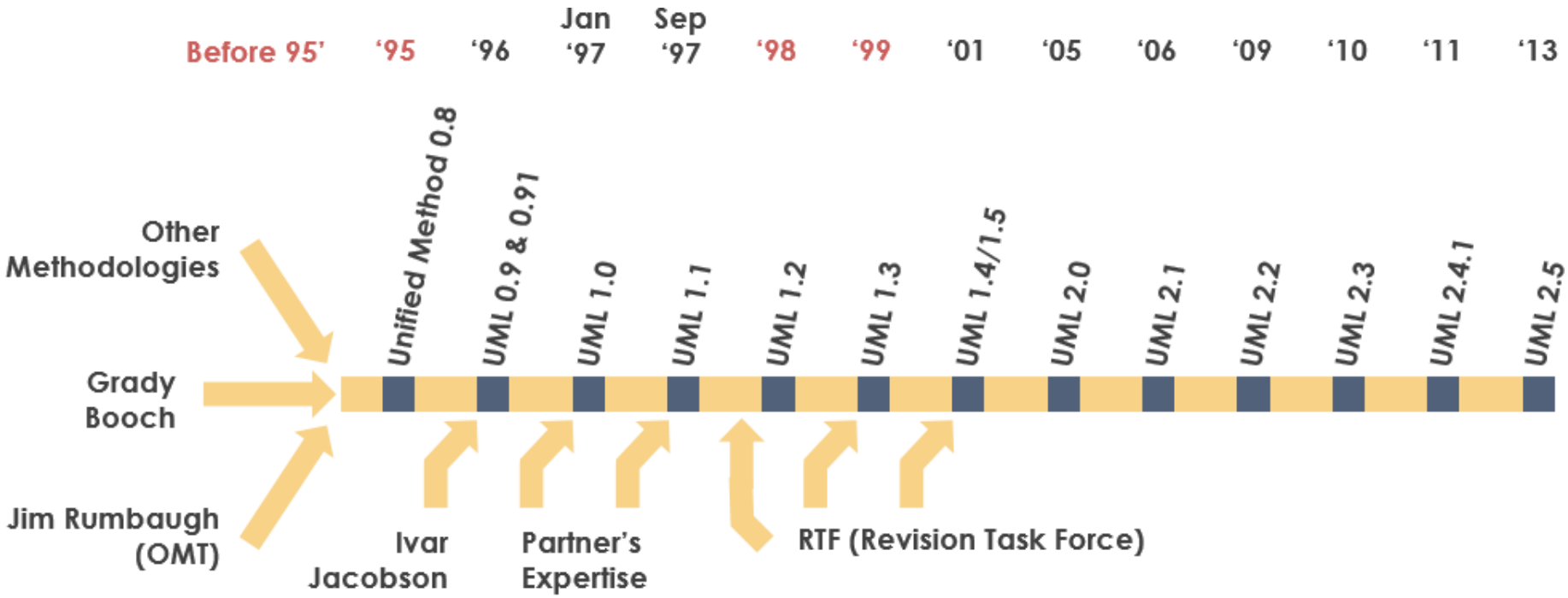
	Paradigm	Diagrams
1	Process-oriented Paradigm	Flowchart
2	Data-oriented Paradigm	DFD
3	Object-oriented Paradigm (data + process)	UML

What is the UML?

- UML: Unified Modeling Language
- UML can be used for modeling all processes in the development life cycle and across different implementation technologies (technology and language independent)
- UML is the standard language for visualizing, specifying, constructing, and documenting the artifacts of a software-intensive system
- UML is a communication tool – for the team, and other stakeholders

Sejarah UML

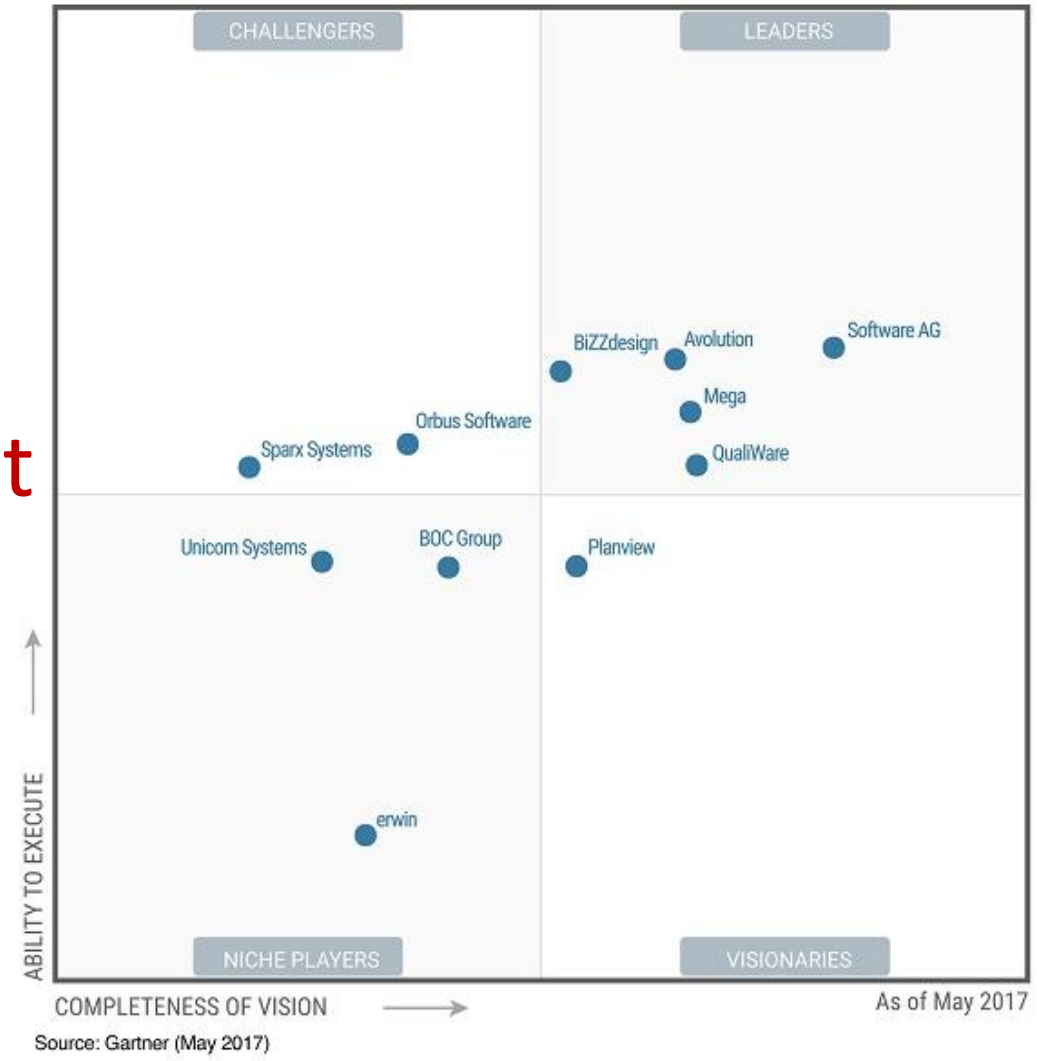
Booch, Jacobson, Rumbaugh



Before 95' - Fragmentation ▶ 95' - Unification ▶ 98' - Standardization ▶ 99' - Industrialization

State of the Art UML Tools

- Rational Rose
- Visual Paradigm
- Sparx Systems Enterprise Architect
- Microsoft Visio
- Star UML



UML 2.0 Diagrams

Diagram Name	Used to	Primary Phase
Structure Diagrams		
Class	Illustrate the relationships between classes modeled in the system.	Analysis, Design
Object	Illustrate the relationships between objects modeled in the system. Used when actual instances of the classes will better communicate the model.	Analysis, Design
Package	Group other UML elements together to form higher level constructs.	Analysis, Design, Implementation
Deployment	Show the physical architecture of the system. Can also be used to show software components being deployed onto the physical architecture.	Physical Design, Implementation
Component	illustrate the physical relationships among the software components.	Physical Design, Implementation
Composite Structure	Illustrate the internal structure of a class, i.e., the relationships among the parts of a class.	Analysis, Design
Behavioral Diagrams		
Activity	Illustrate business workflows independent of classes, the flow of activities in a use case, or detailed design of a method.	Analysis, Design
Sequence	Model the behavior of objects within a use case. Focuses on the time-based ordering of an activity.	Analysis, Design
Communication	Model the behavior of objects within a use case. Focuses on the communication among a set of collaborating objects of an activity.	Analysis, Design
Interaction Overview	Illustrate an overview of the flow of control of a process.	Analysis, Design
Timing	Illustrate the interaction that takes place among a set of objects and the state changes in which they go through along a time axis.	Analysis, Design
Behavioral State Machine	Examine the behavior of one class.	Analysis, Design
Protocol State Machine	Illustrates the dependencies among the different interfaces of a class.	Analysis, Design
Use-Case	Capture business requirements for the system and to illustrate the interaction between the system and its environment.	Analysis

UML Problems

1. UML is modeling notation, it is not a development process or a methodology
   - UML driven development process?

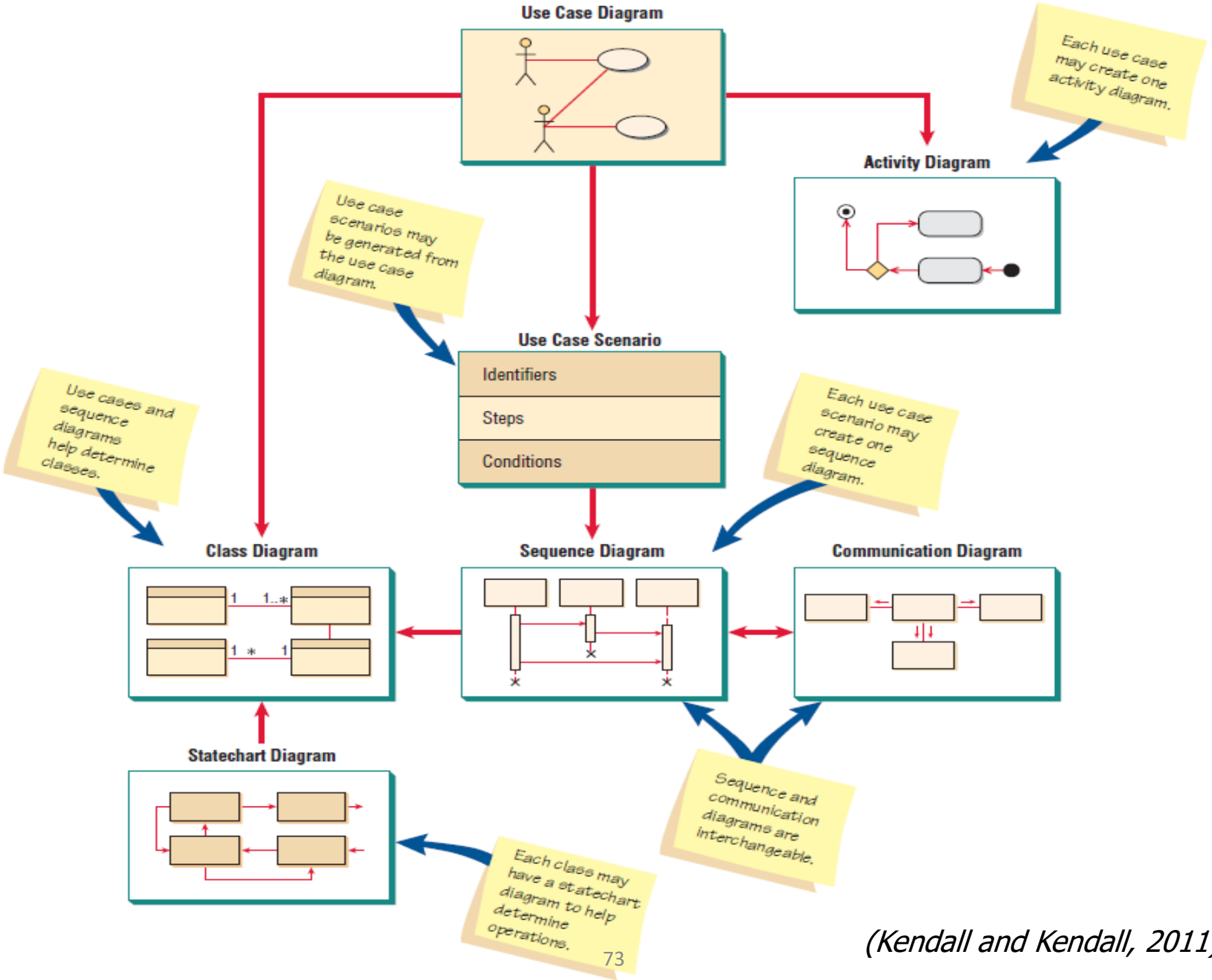
2. UML is too complex, difficult to understand quickly
   - Which UML diagrams should we use?

UML based Software Analysis and Design (*Sparx Systems EA*)

1. Display the boundary of a system and its major functions using use cases and actors
2. Model the organization's business process with activity diagram
3. Illustrate use case realizations with sequence diagrams
4. Represent a static structure of a system using class diagrams
5. Reveal the physical implementation architecture with deployment diagrams

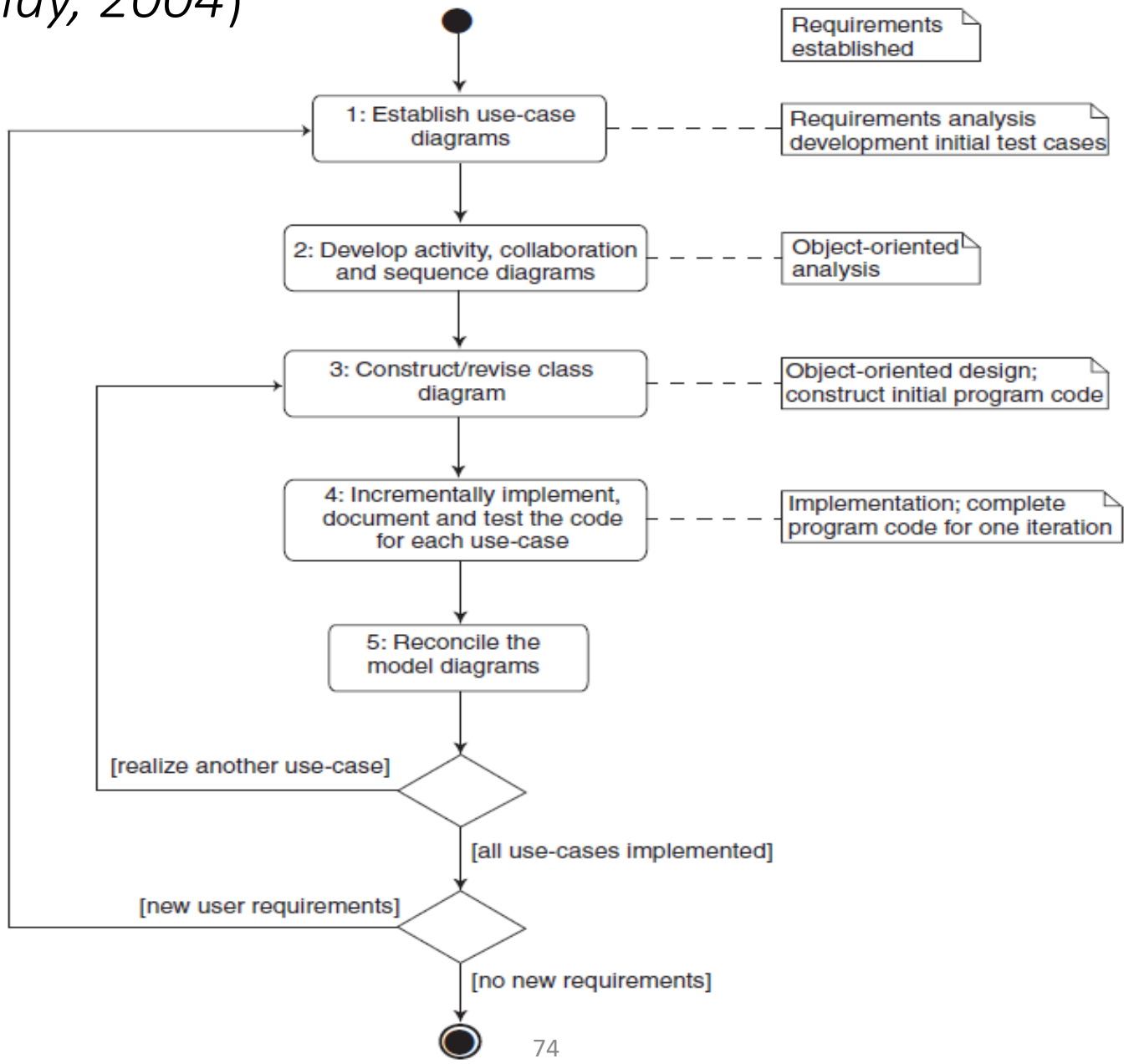
UML based Software Analysis and Design (*Kendal, 2011*)

1. A use case diagram, describing how the system is used. Analysts start with a use case diagram
2. An activity diagram, illustrating the overall flow of activities. Each use case may create one activity diagram
3. Sequence diagrams, showing the sequence of activities and class relationships. Each use case may create one or more sequence diagrams
4. Class diagrams, showing the classes and relationships. Sequence diagrams are used to determine classes
5. Statechart diagrams, showing the state transitions. Each class may create a statechart diagram, which is useful for determining class methods



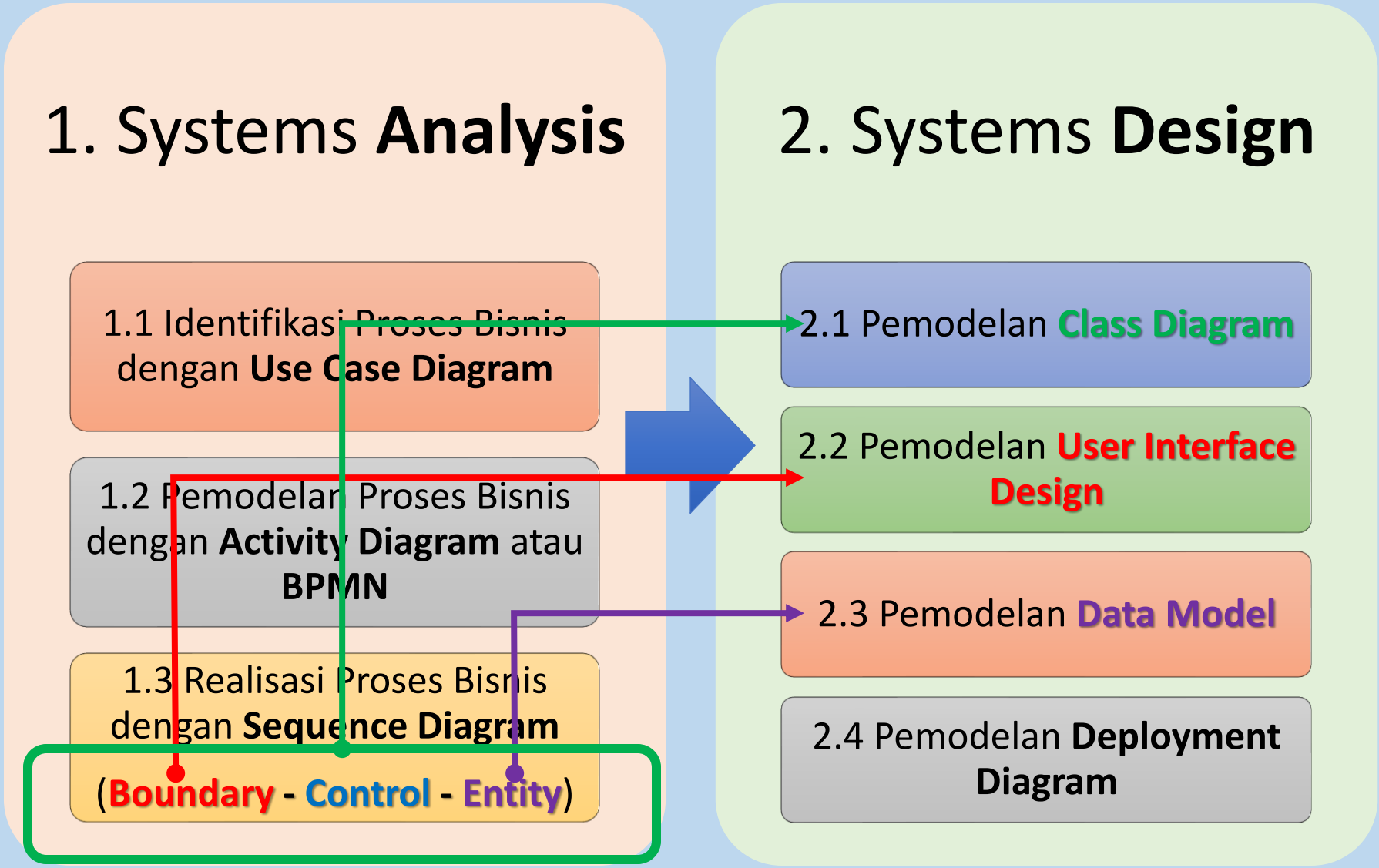
(Kendall and Kendall, 2011)

UML based Software Analysis and Design (*Barclay, 2004*)

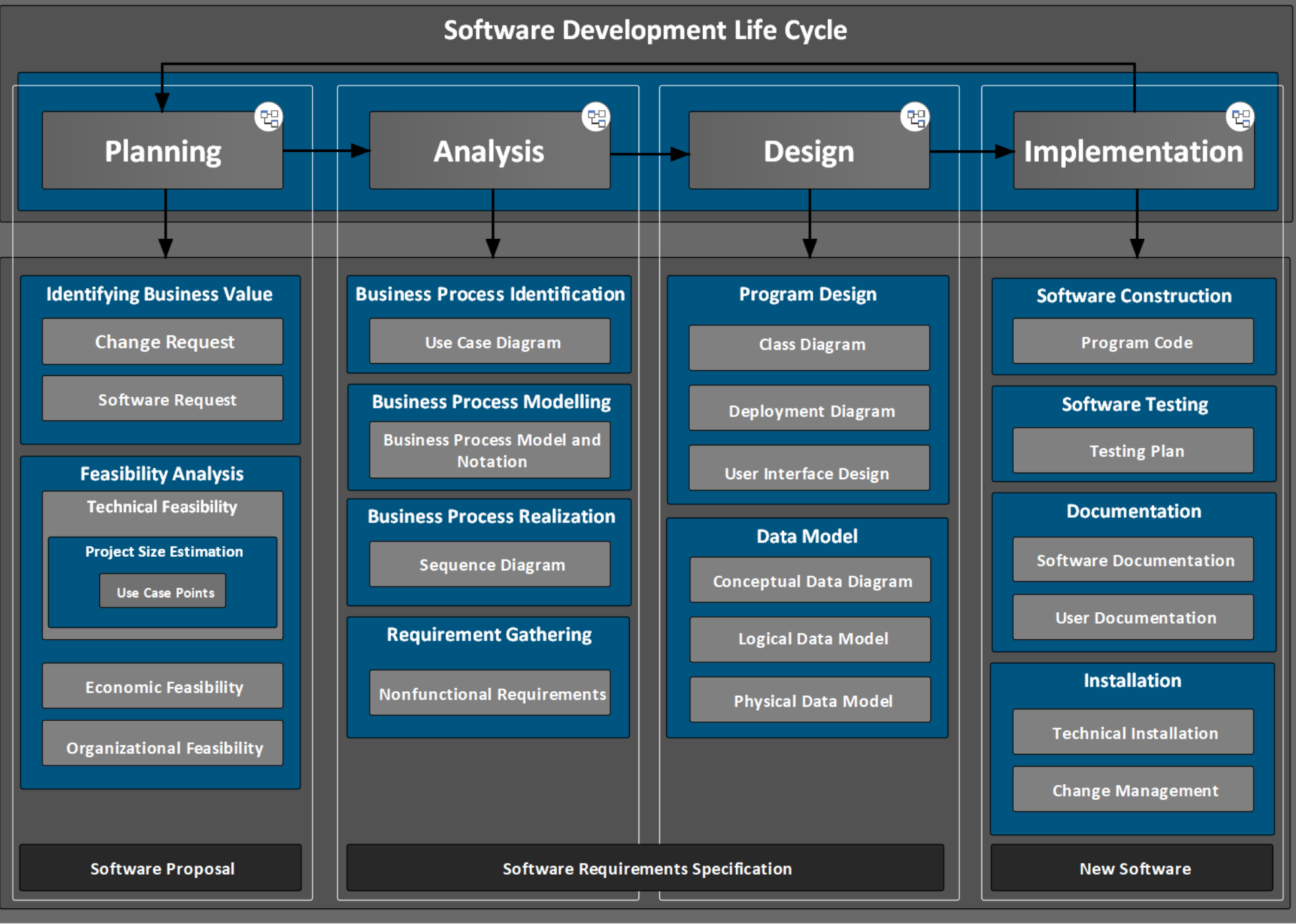


UML based Software Analysis and Design

(Wahono, 2009)

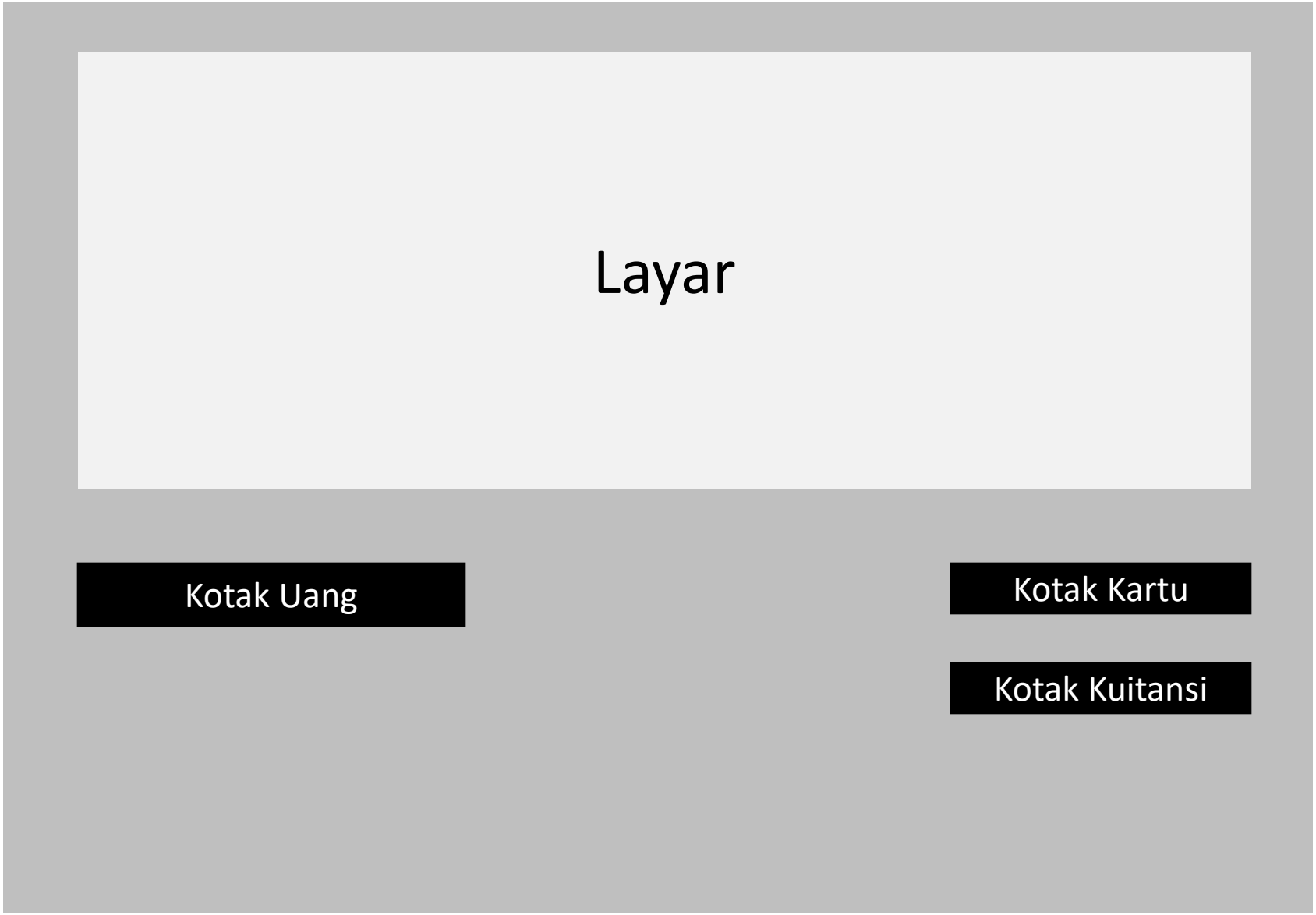


Application Development Governance



Studi Kasus: ATM System

ATM System



Menu PIN

Masukkan PIN:

Kotak Uang

Kotak Kartu

Kotak Kuitansi

Menu Utama

1. Mengecek Saldo
2. Mentransfer Uang
3. Mengambil Uang
4. Logout

Kotak Uang

Kotak Kartu

Kotak Kuitansi

Menu Pengecekan Saldo

1. Saldo anda adalah …

Kotak Uang

Kotak Kartu

Kotak Kuitansi

Menu Pengiriman Uang

1. No Account Penerima:

Kotak Uang

Kotak Kartu

Kotak Kuitansi

Menu Pengiriman Uang

1. Jumlah uang yang dikirim:

Kotak Uang

Kotak Kartu

Kotak Kuitansi

Menu Pengiriman Uang

1. Uang berhasil terkirim

Kotak Uang

Kotak Kartu

Kotak Kuitansi

Menu Pengambilan Uang

1. Jumlah uang yang diambil:

Kotak Uang

Kotak Kartu

Kotak Kuitansi

Menu Pengambilan Uang

Uang berhasil diambil

Kotak Uang

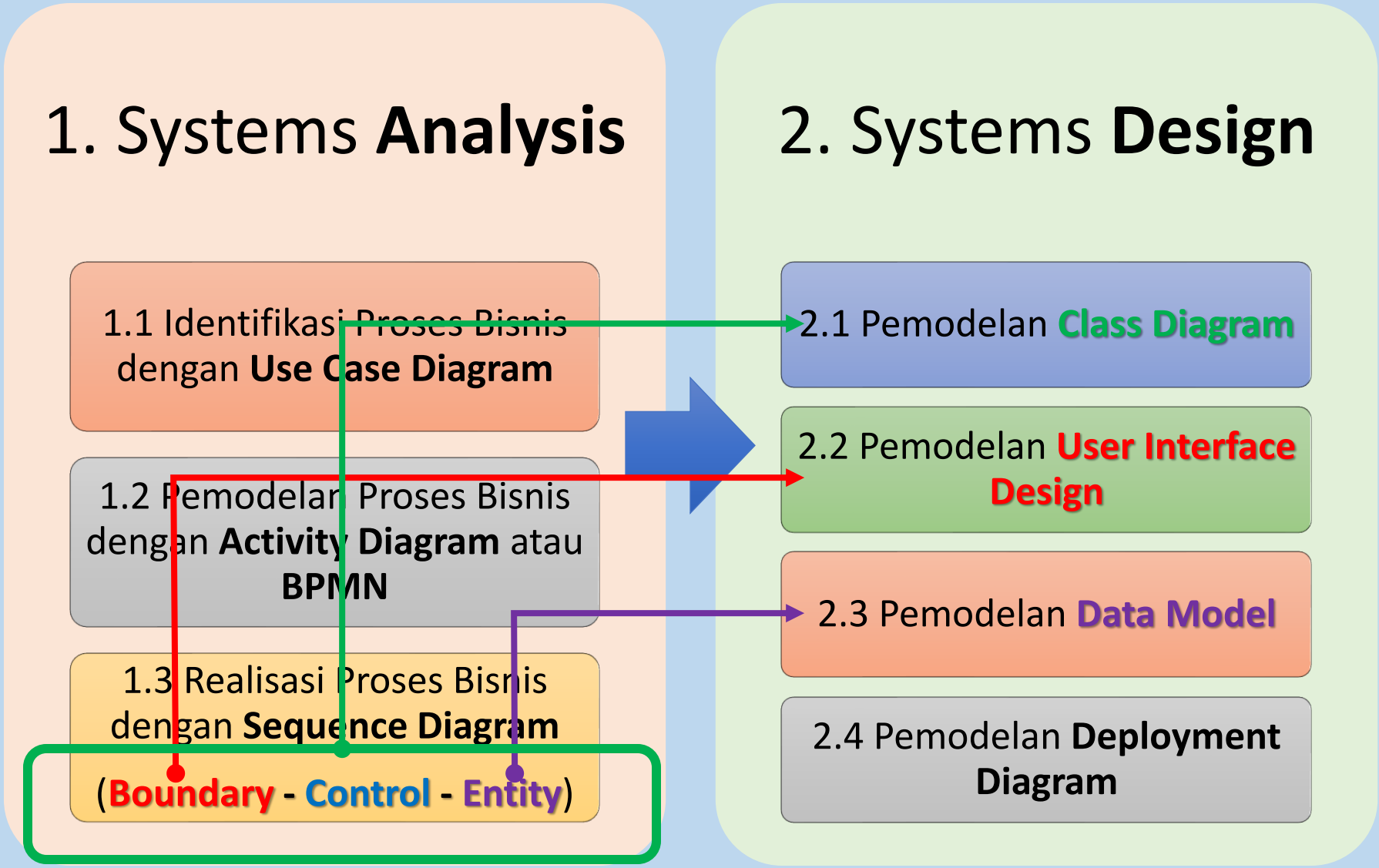
Kotak Kartu

Kotak Kuitansi

2.2 Identifikasi Proses Bisnis dengan Use Case Diagram

UML based Software Analysis and Design

(Wahono, 2009)

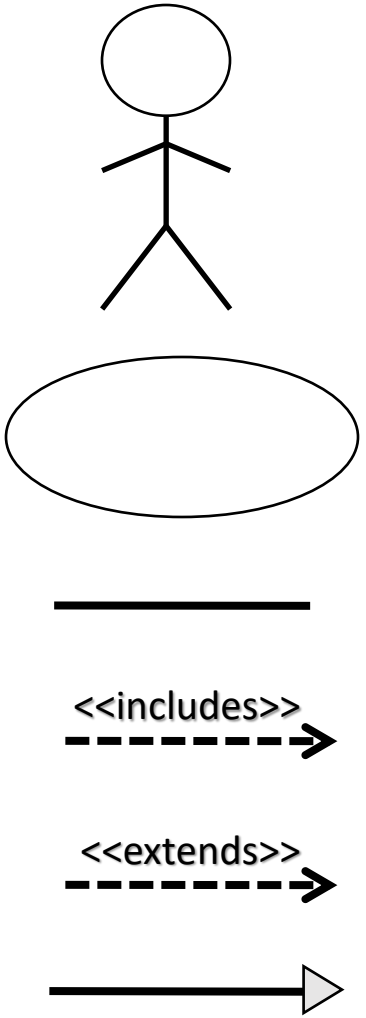


Use Case Diagram

- Summarized into a single picture
- All of the use cases for the part of the system being modeled
- Use case represents the discrete activities performed by the user
- Use Case Diagram tells what the system will do
- Good for communicating with users

Use Case Diagram Syntax

- Actor
  - person or system that derives benefit from and is external to the subject
- Use Case
  - Represents a major piece of system functionality
- Association Relationship
- Include Relationship
- Extend Relationship
- Generalization Relationship

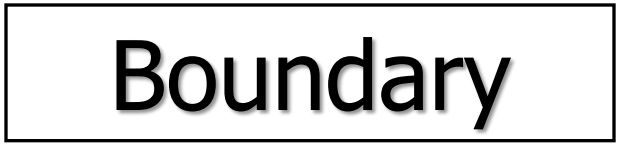


Use Case

- A major piece of system functionality
- Can extend other Use Cases
- Placed inside system boundary
- Labeled with descriptive verb - noun phrase

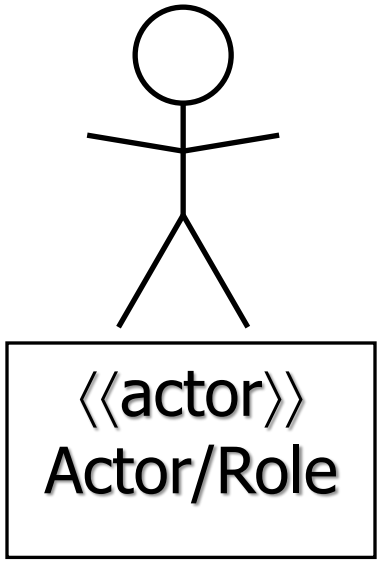
System Boundary

- Includes the name of the system inside or on top
- Represents the scope of the system
- Actors are outside the scope of the system



Actor

- A person or another system that interacts with the current system
- A role, not a specific user
- Provides input, receives output, or both

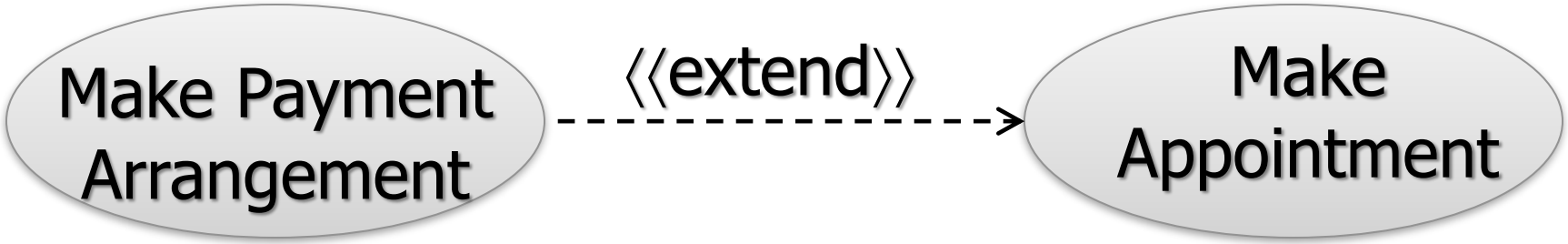


Association Relationship

- Links actor and the Use Case
- Shows two-way communication
  - If one-way, arrows are used

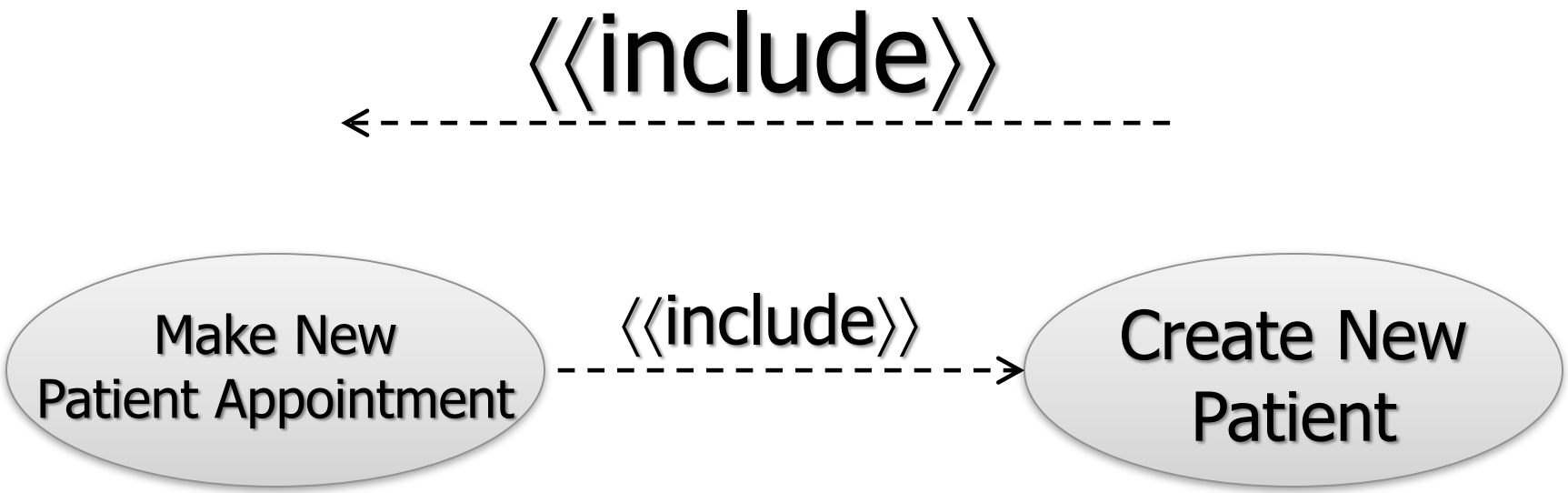
Extends Relationship

- Extends Use Case to include Optional behavior
- Arrow points from the extension Use Case to the base Use Case



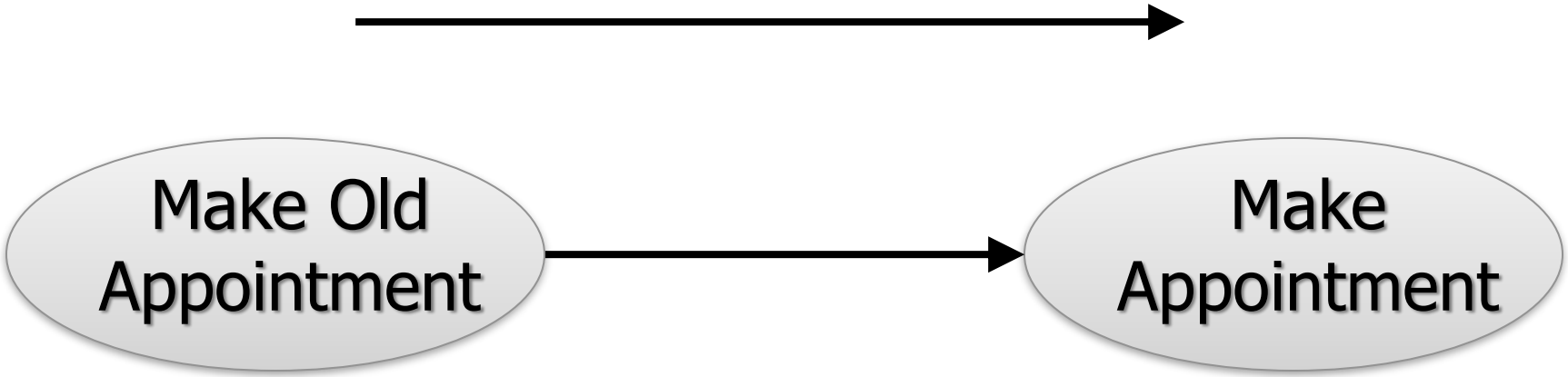
Include Relationship

- Include one Use Case from within another
- Arrow points from base Use Case to the included Use Case

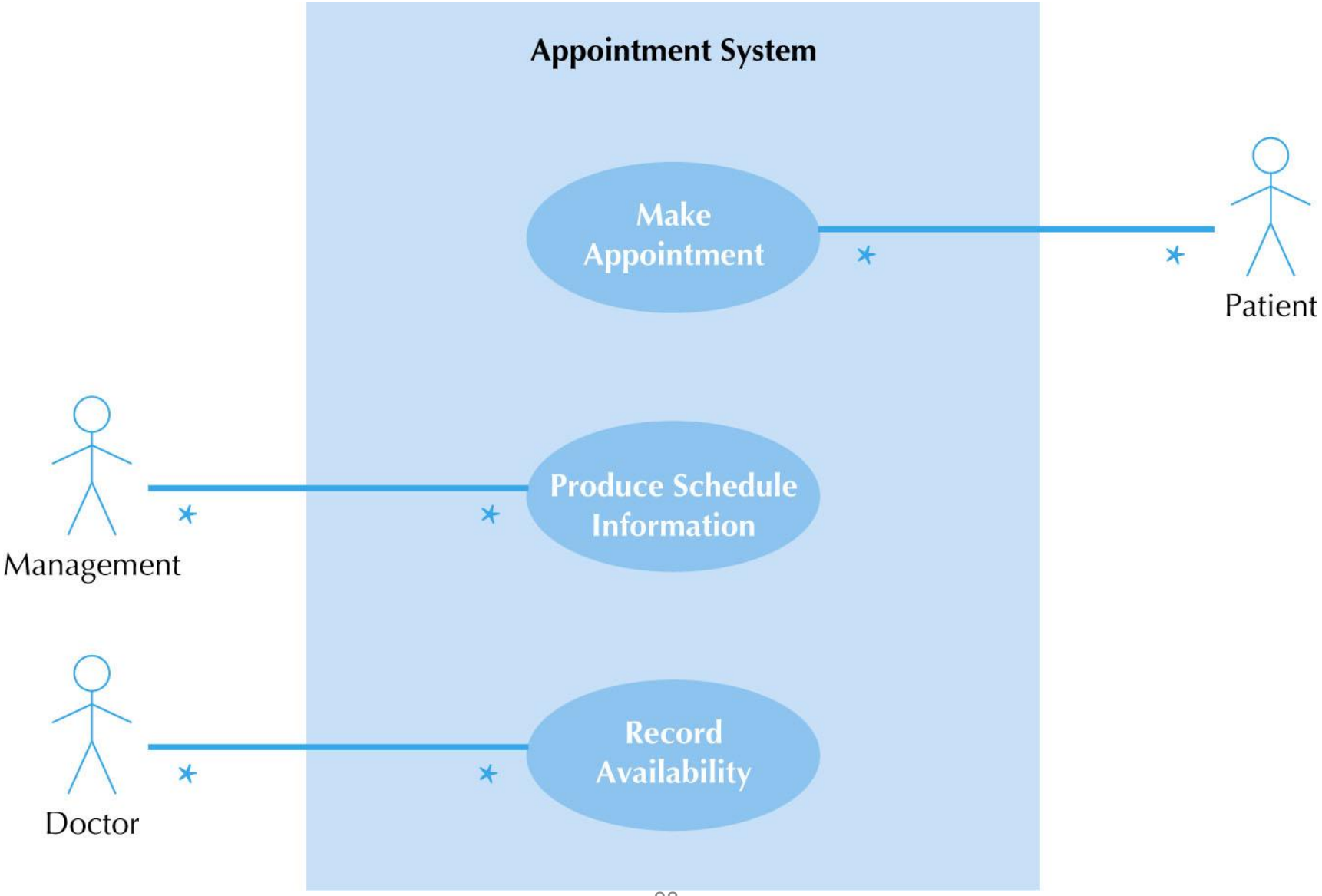


Generalization Relationship

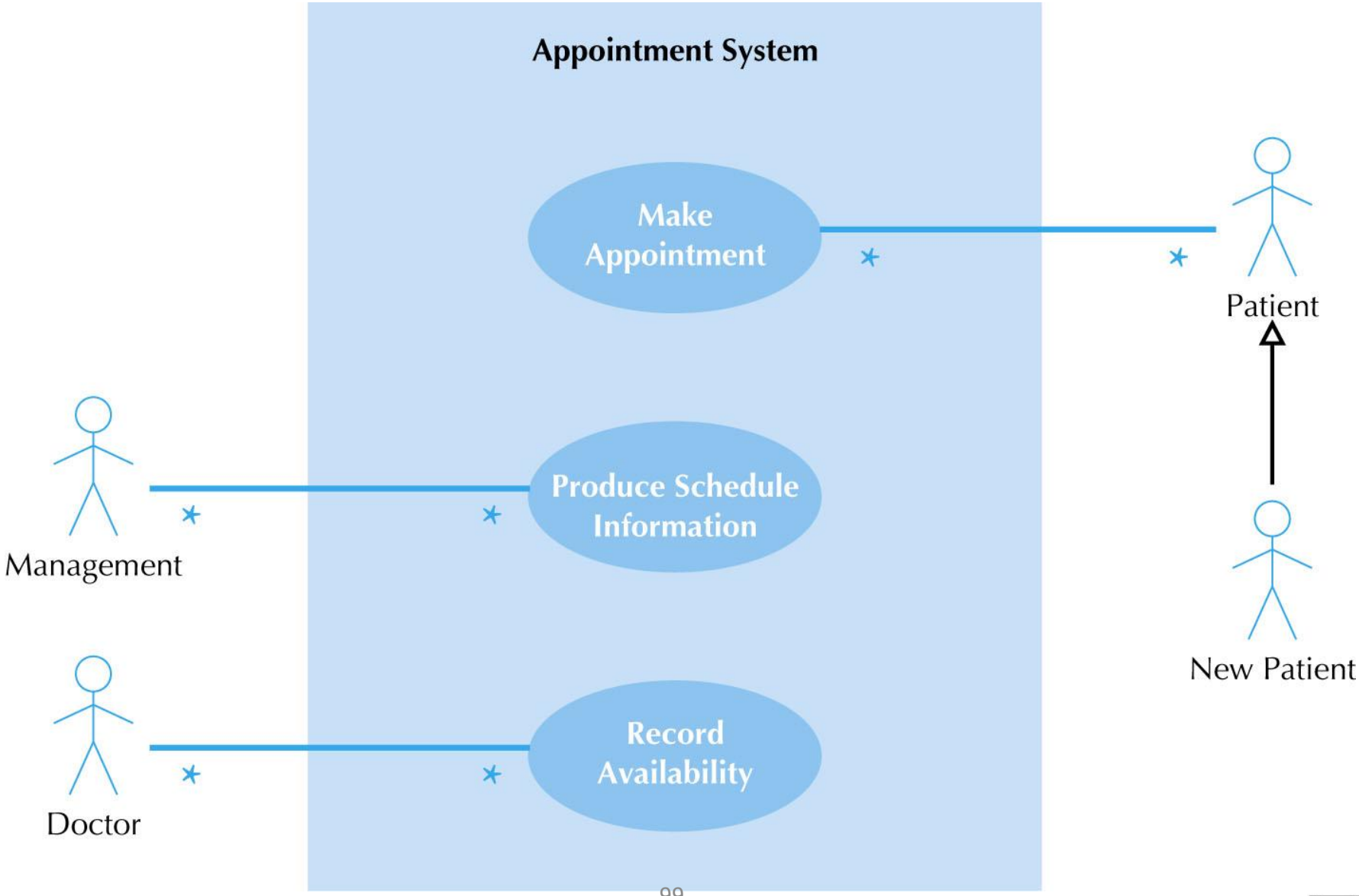
- A specialized Use Case to a more generalized Use Case
- Arrow points from specialized to general Use Case



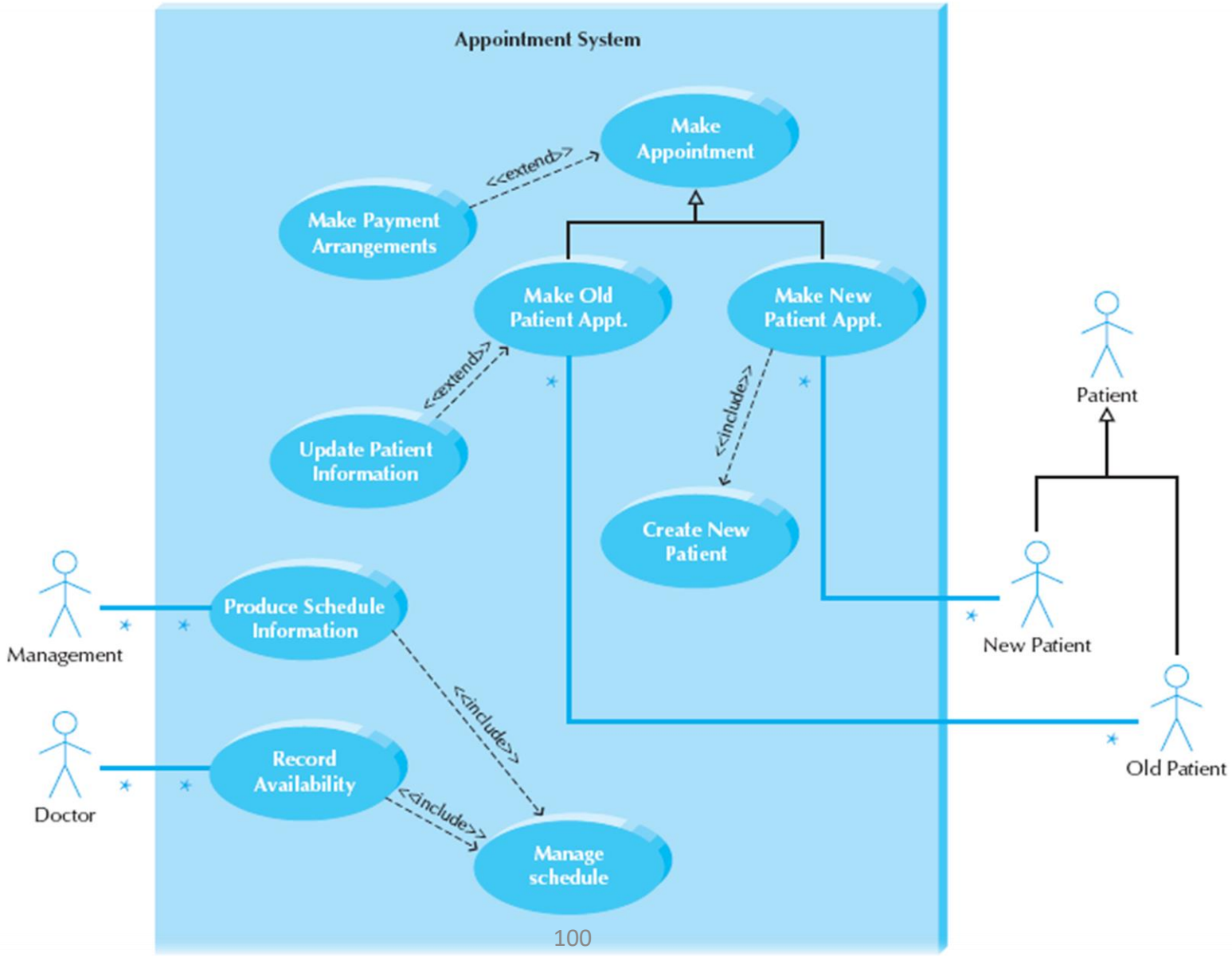
Use Case Diagram for Appointment System



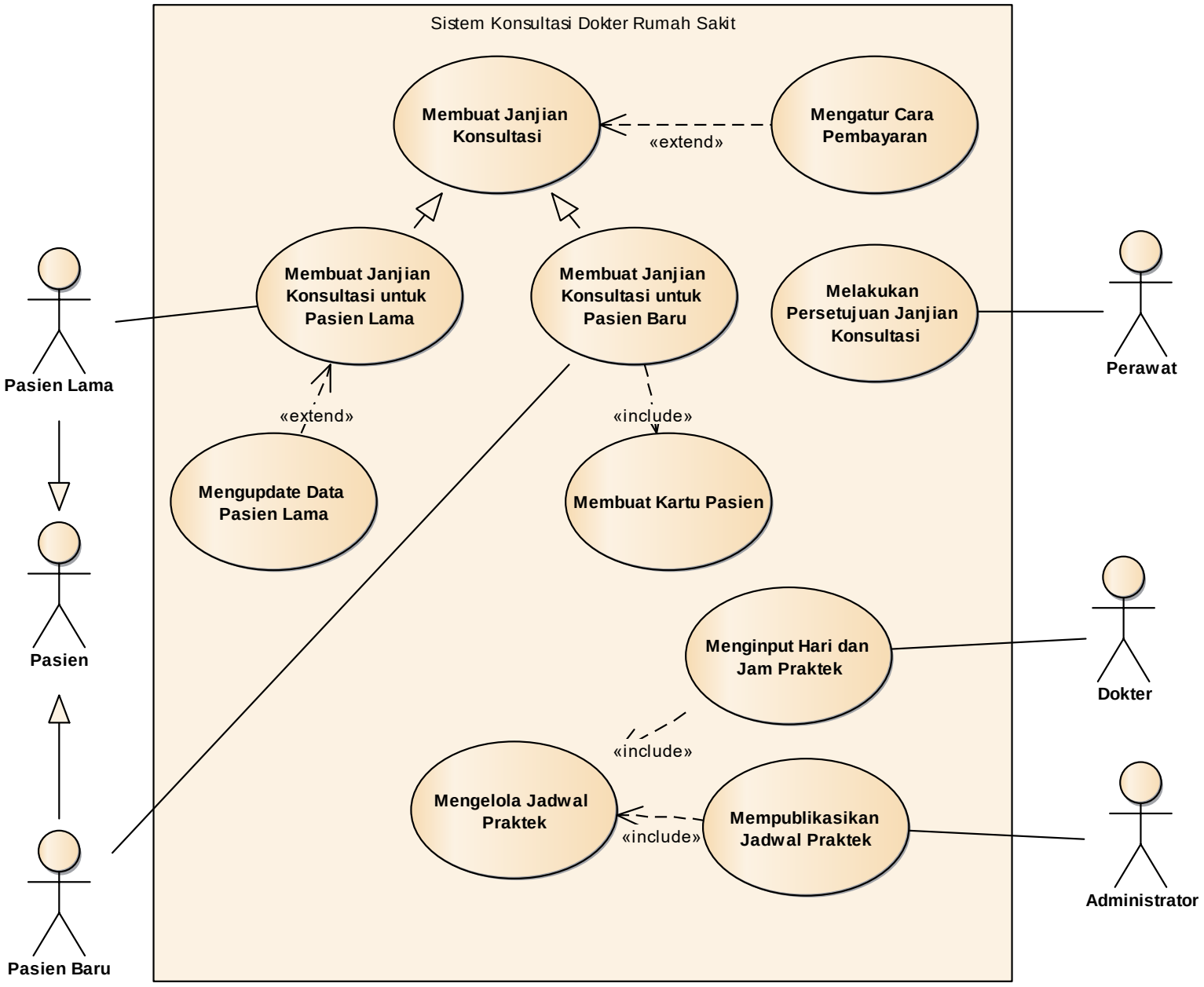
Use Case Diagram with Specialized Actor



Extend and Include Relationships

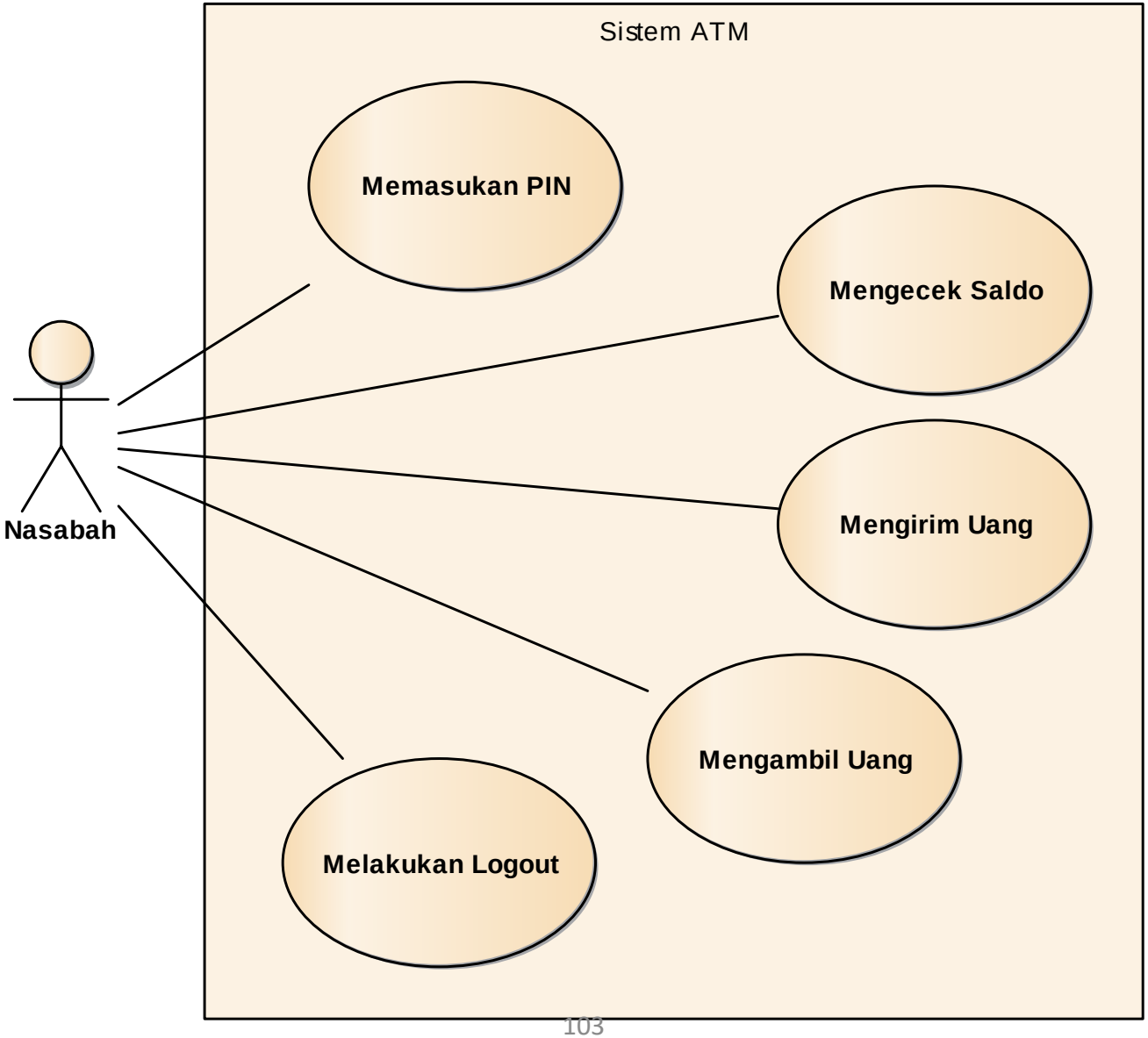


Sistem Konsultasi Dokter Rumah Sakit

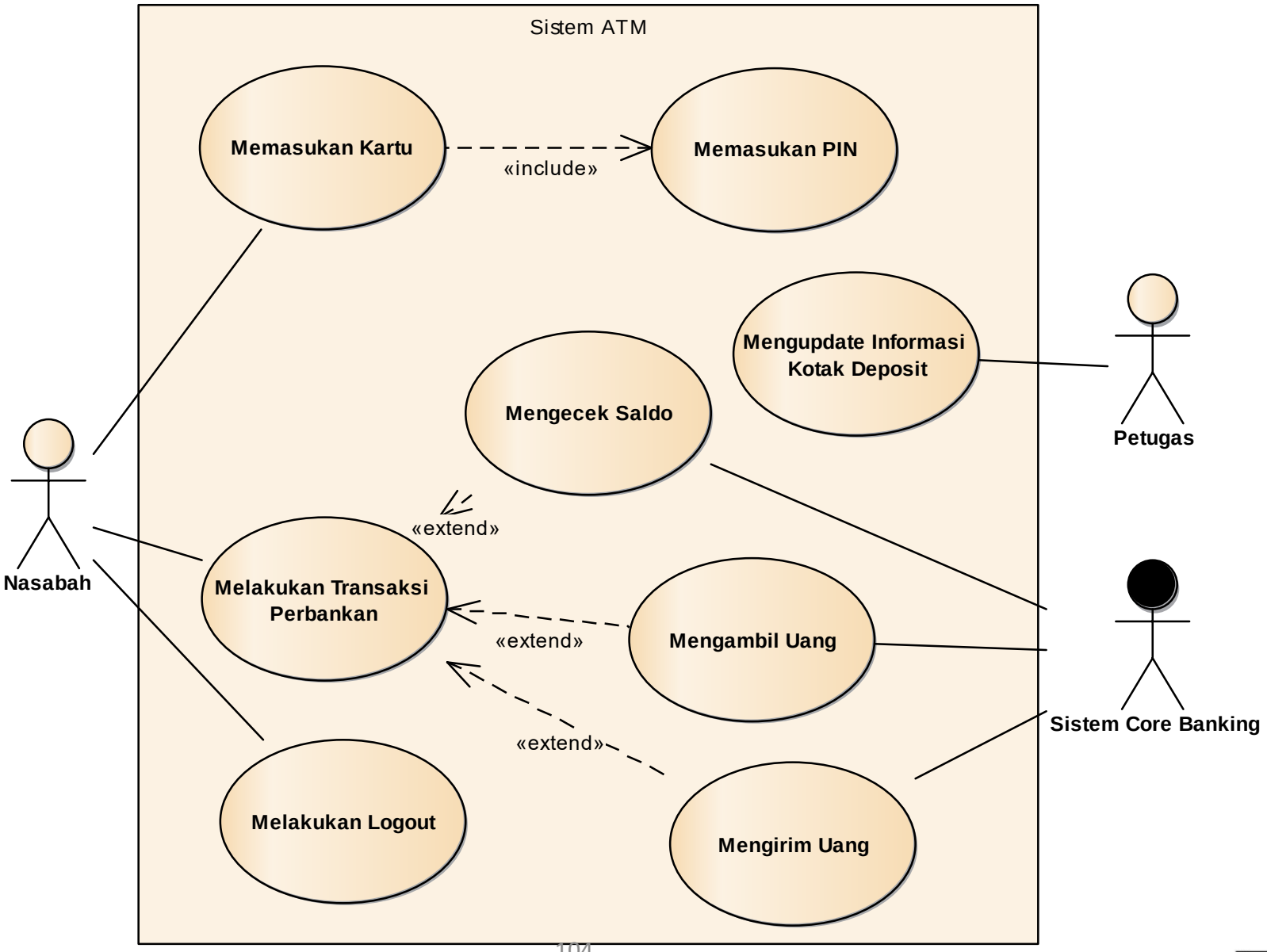


Studi Kasus: Use Case Diagram Sistem ATM

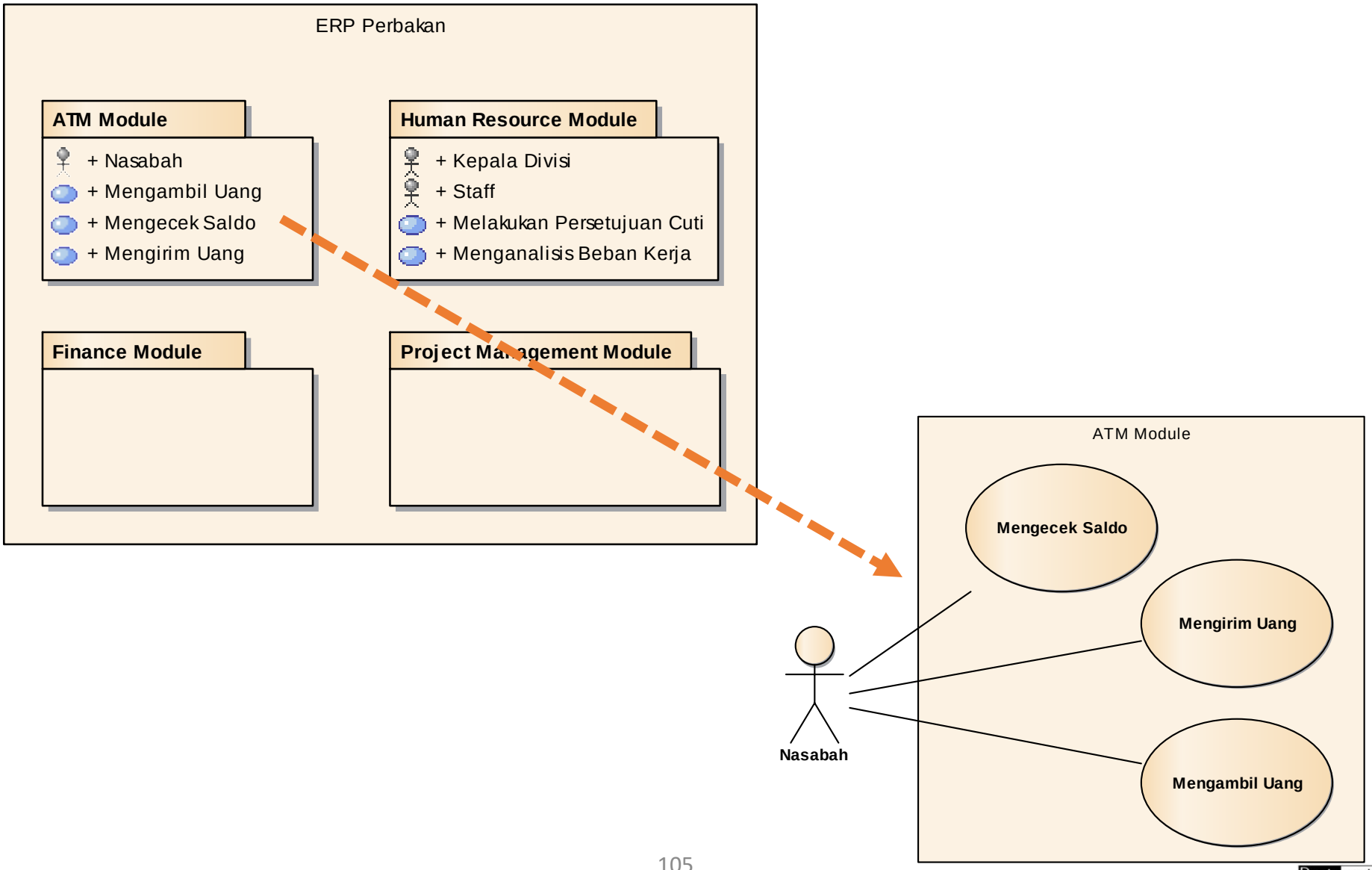
Use Case Diagram Sistem ATM
(versi Sederhana)



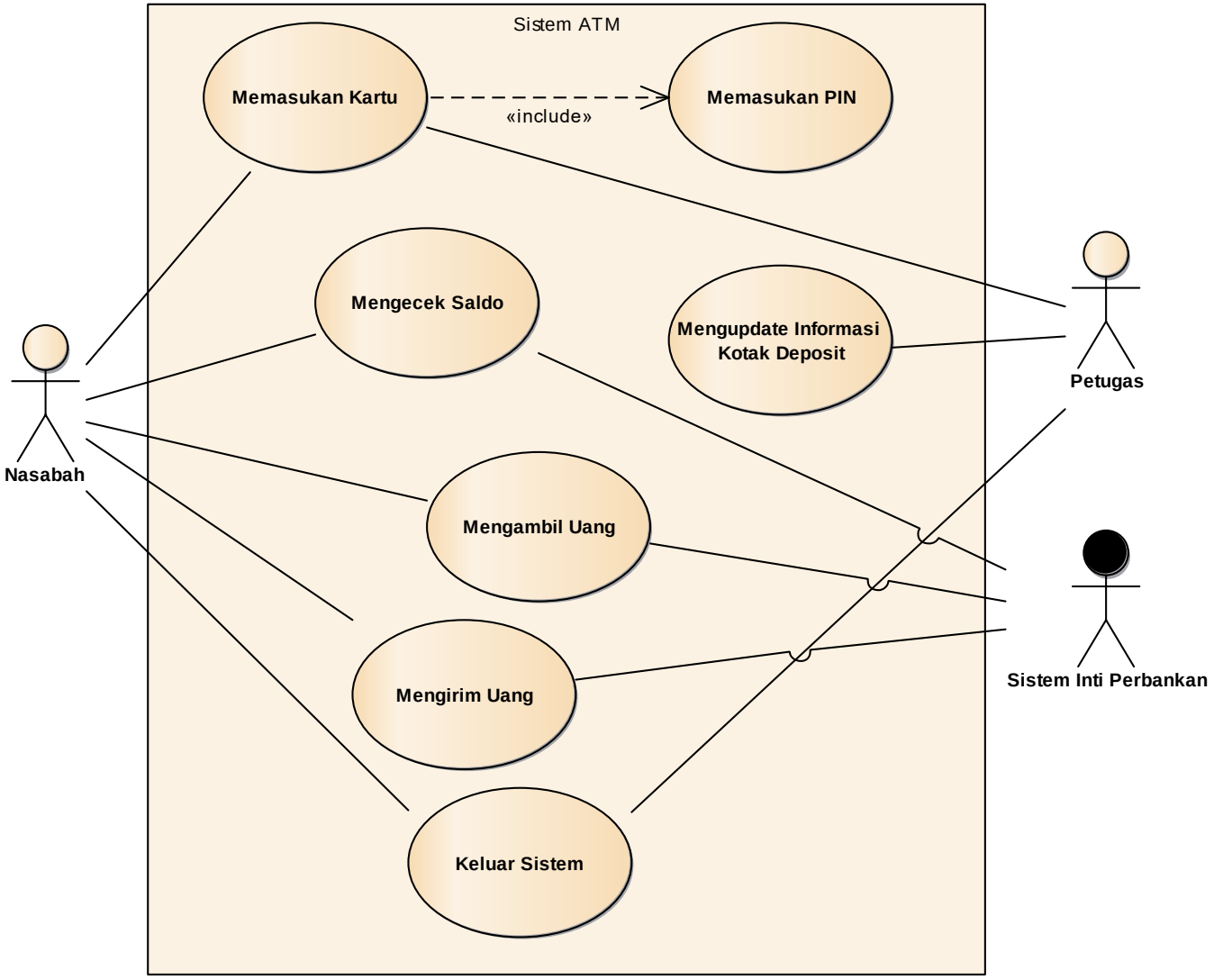
Use Case Diagram Sistem ATM
(Versi Include dan Extends)

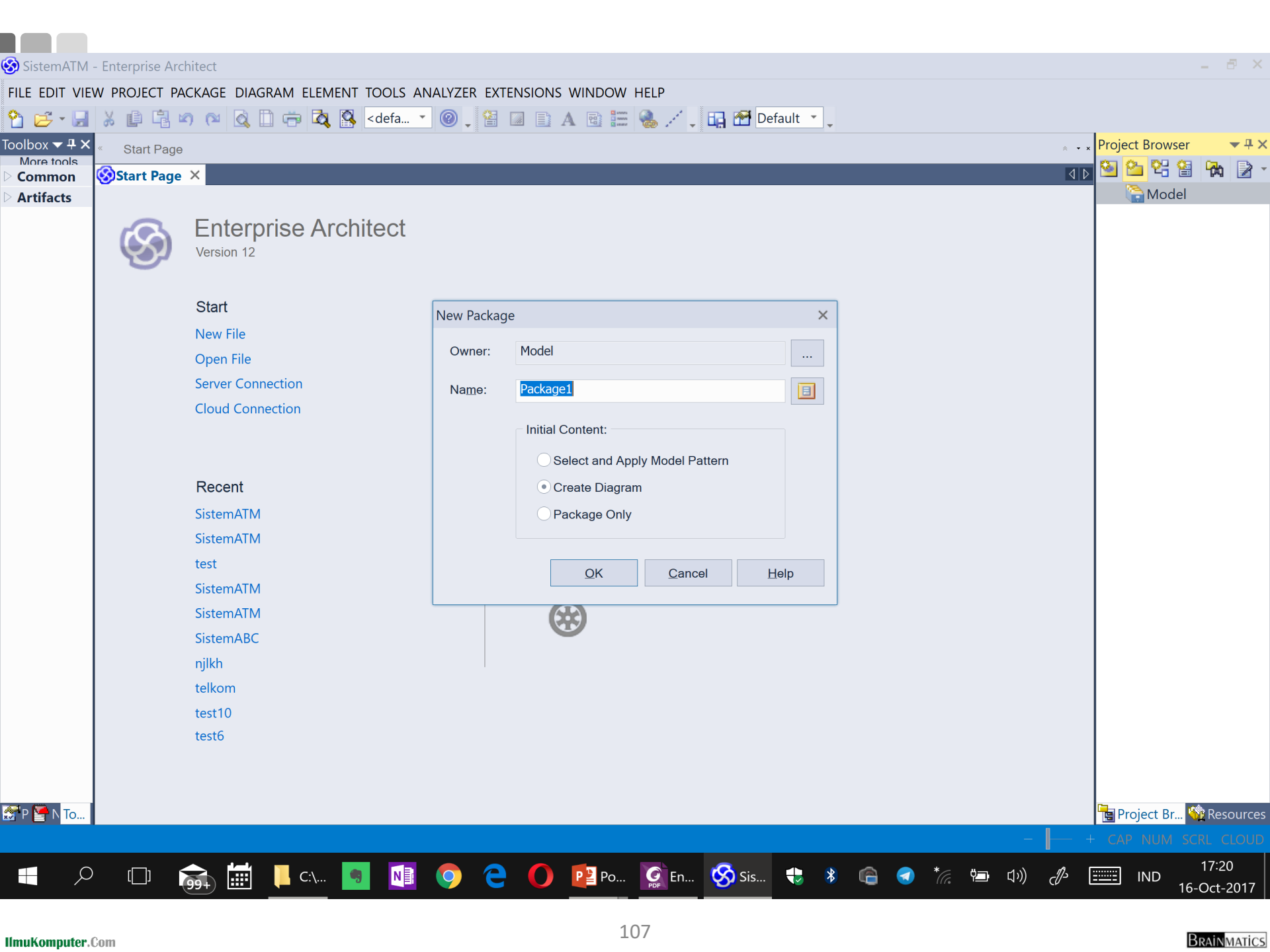


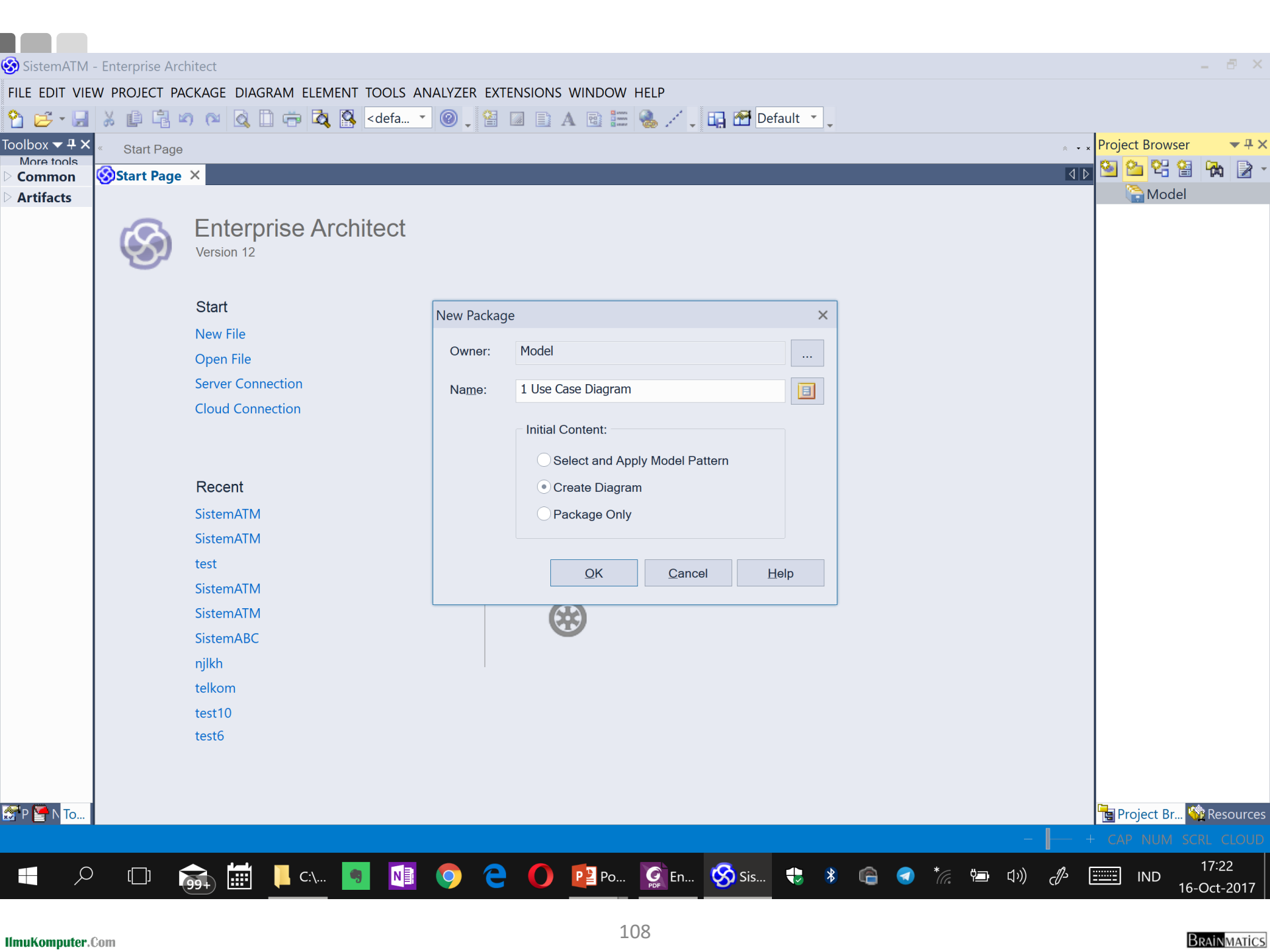
Use Case Diagram ERP Perbankan
(Sistem Lebih Kompleks)

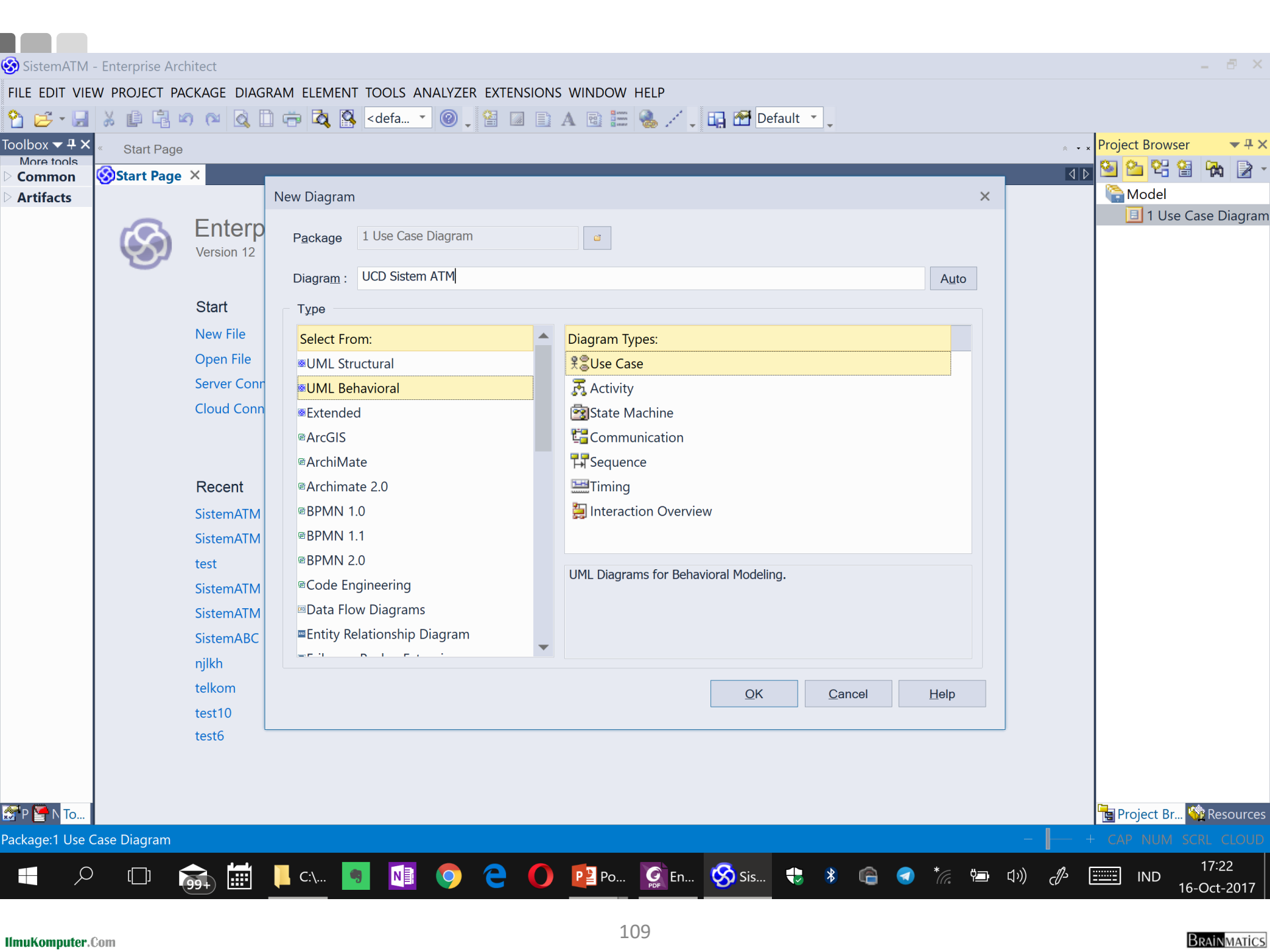


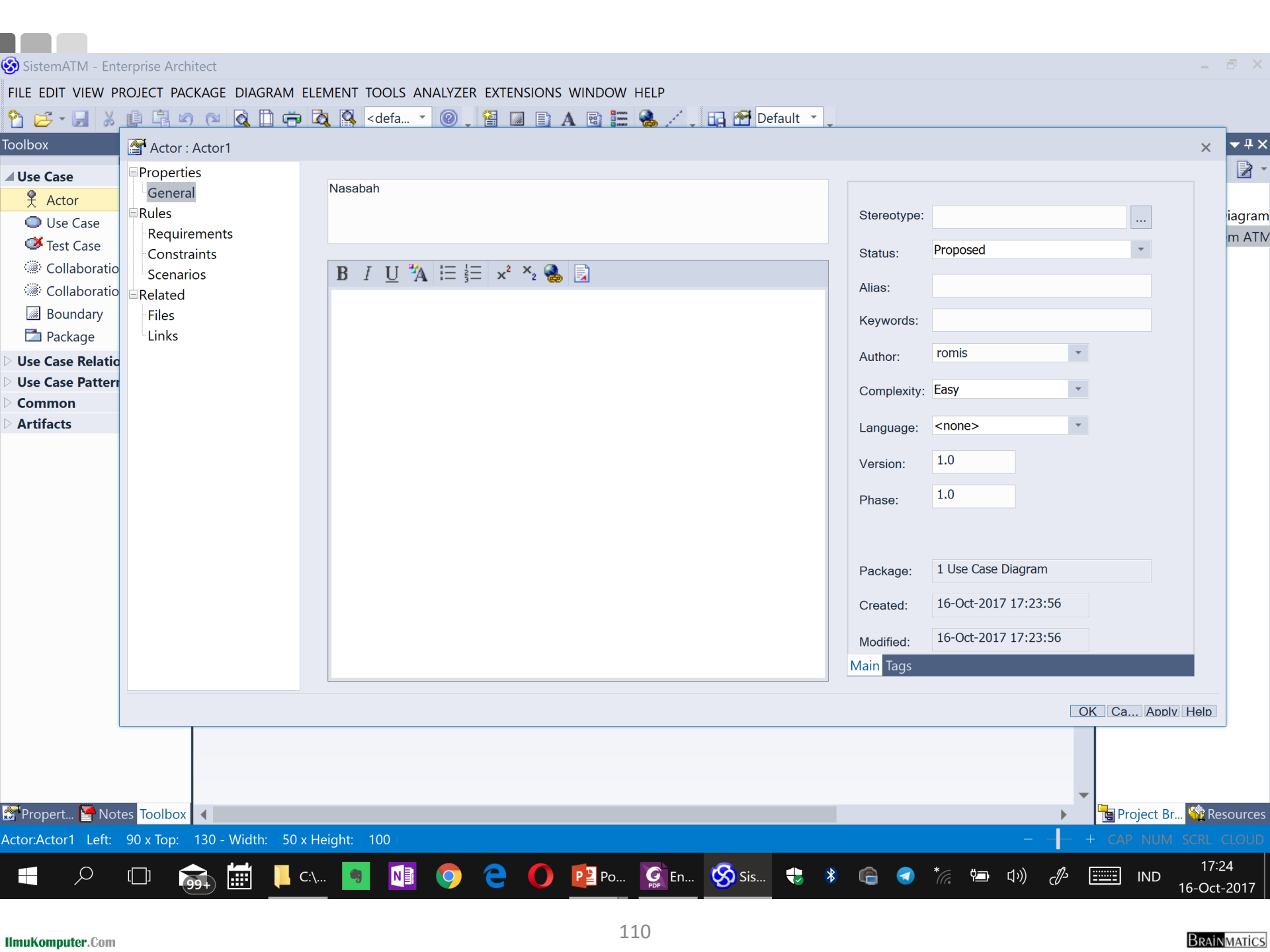
Use Case Diagram Sistem ATM
(Versi Normal)











SistemATM - Enterprise Architect

FILE EDIT VIEW PROJECT PACKAGE DIAGRAM ELEMENT TOOLS ANALYZER EXTENSIONS WINDOW HELP

Toolbox

More tools

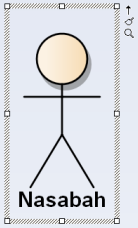
Use Case
- Actor
- Use Case
- Test Case
- Collaboration
- Collaboration Use
- Boundary
- Package

Use case and Actor elements for Usecase diagrams

Use Case Relationships
Use Case Patterns
Common
Artifacts

Use Case Diagram: "UCD Sistem ATM"

Start Page | *UCD Sistem ATM



Project Browser

Model
1 Use Case Diagram
UCD Sistem ATM
Nasabah

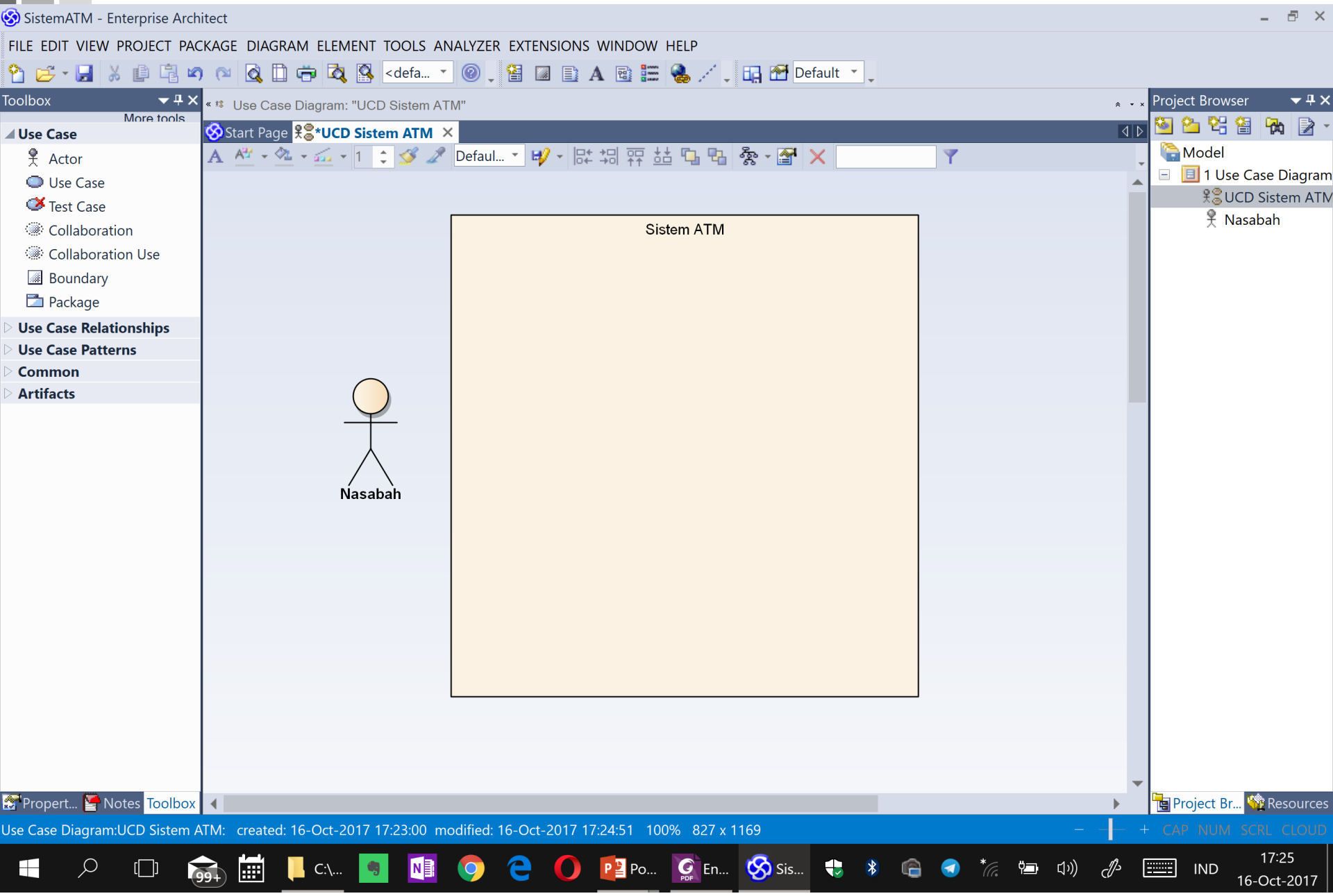
Propert... Notes Toolbox

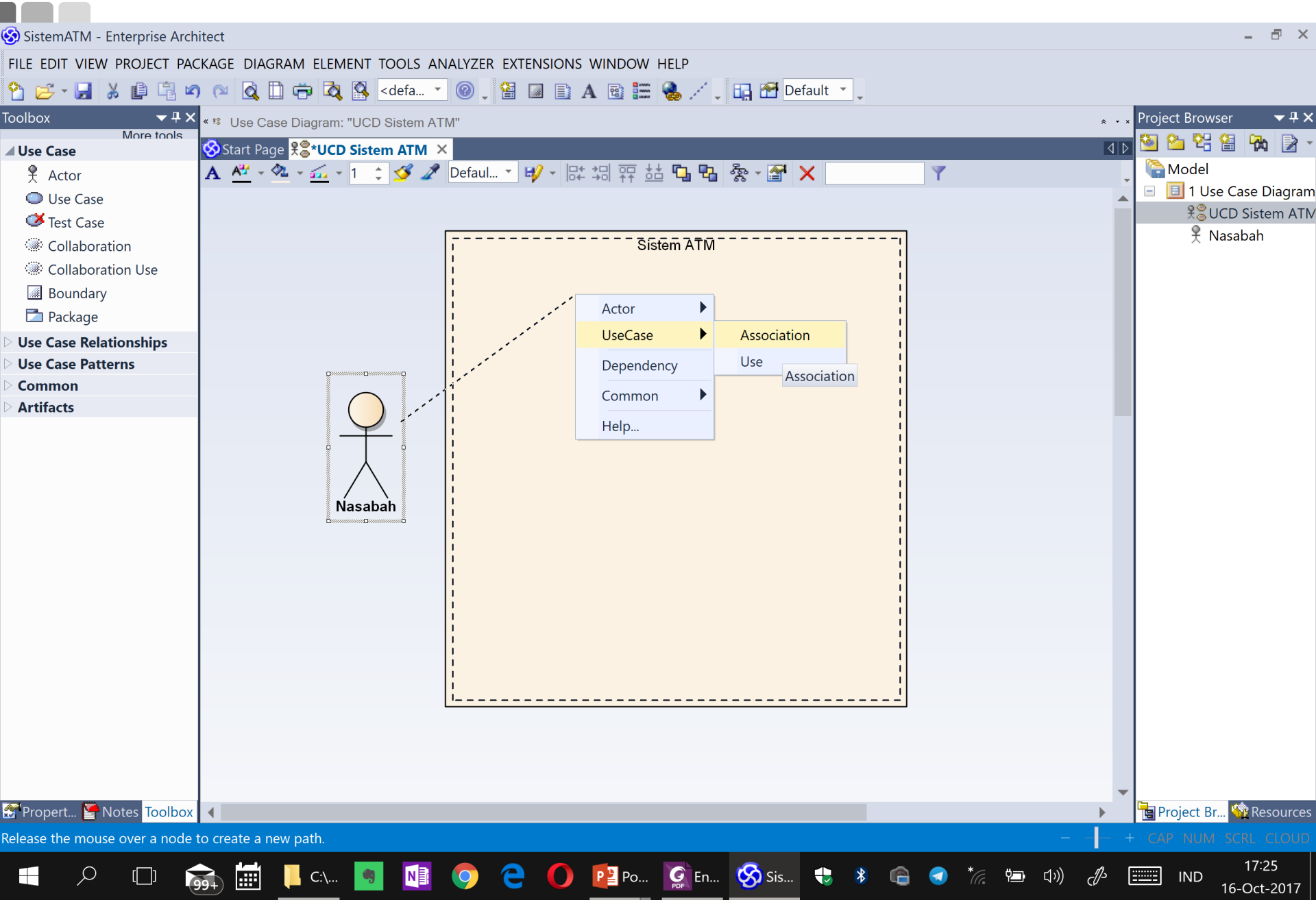
Project Br... Resources

Actor:Nasabah Left: 90 x Top: 130 - Width: 50 x Height: 100

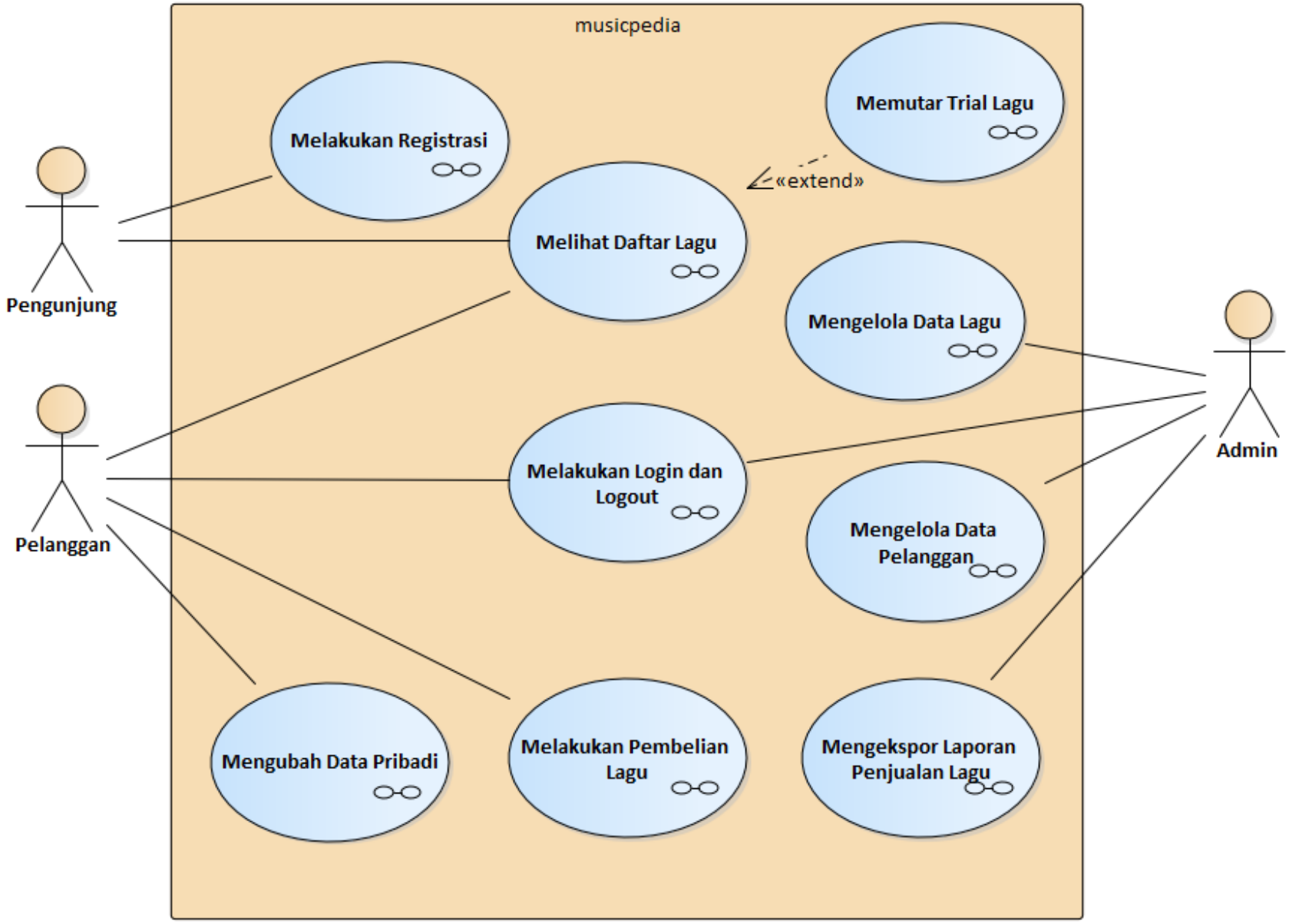
CAP NUM SCRL CLOUD

IND 17:24 16-Oct-2017





Use Case Diagram MusicPedia



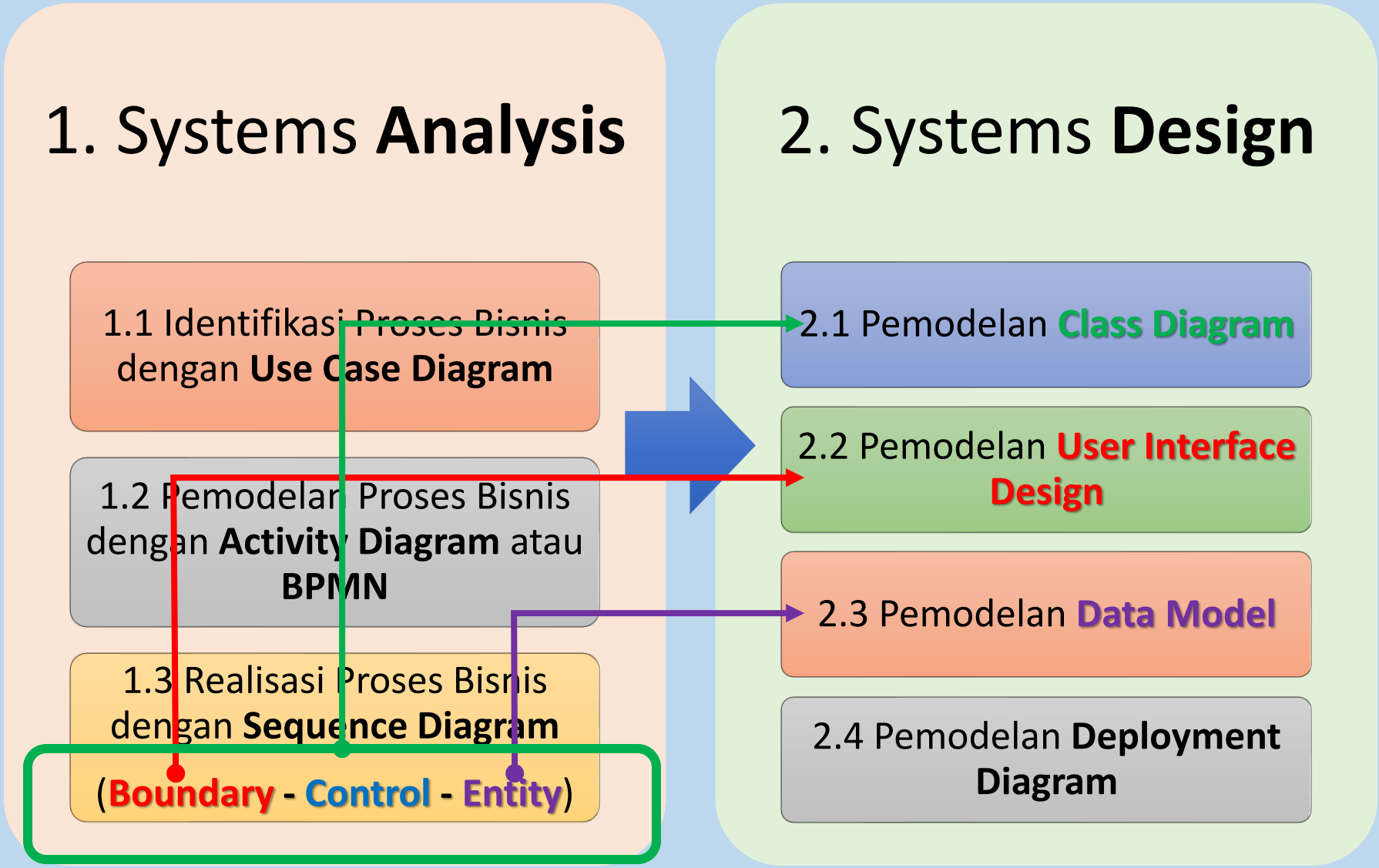
2.3 Pemodelan Proses Bisnis dengan AD atau BPMN

2.3.1 Activity Diagram

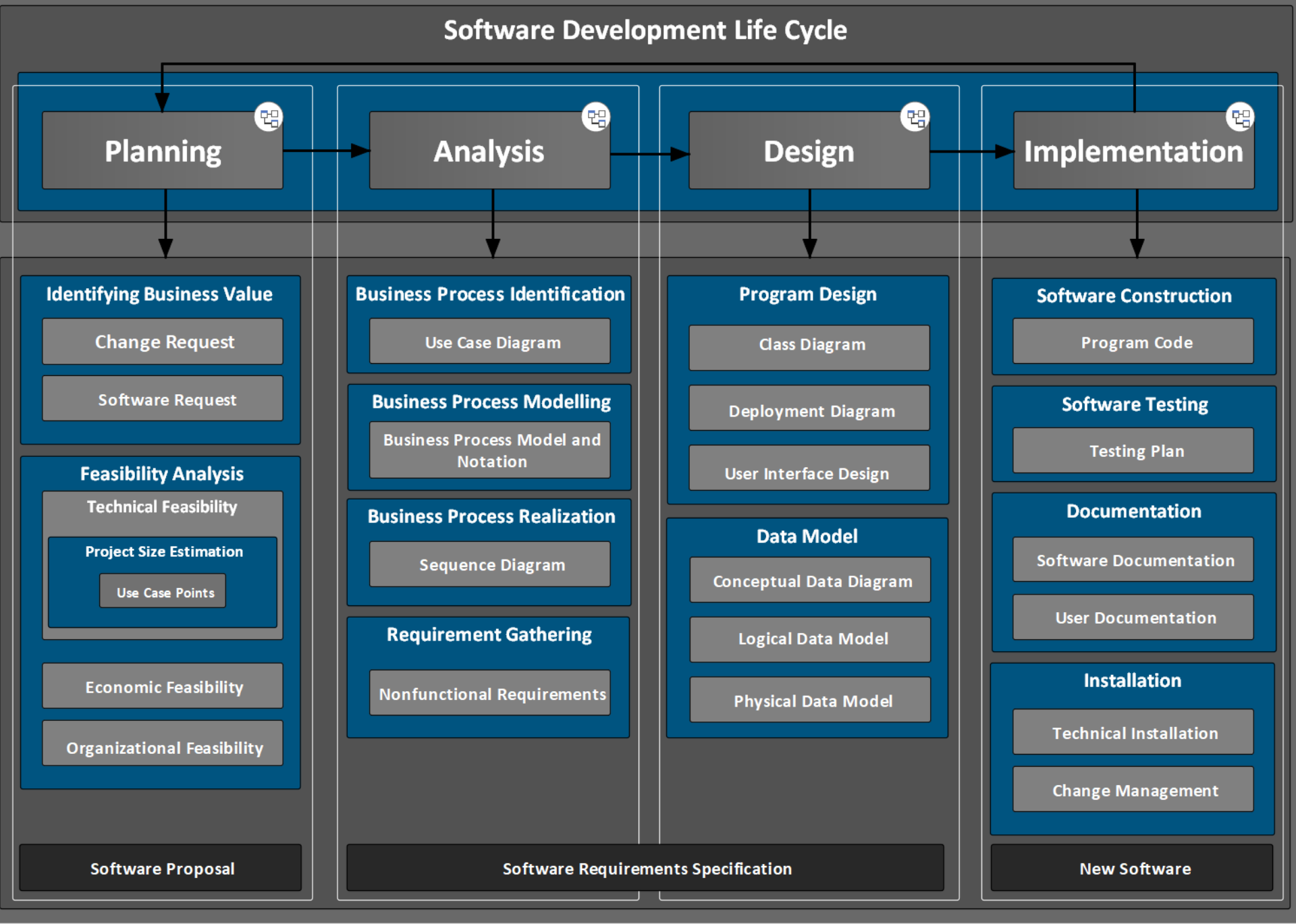
2.3.2 Business Process Model and Notation (BPMN)

UML based Software Analysis and Design

(Wahono, 2009)

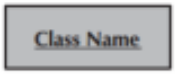
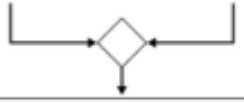


Application Development Governance



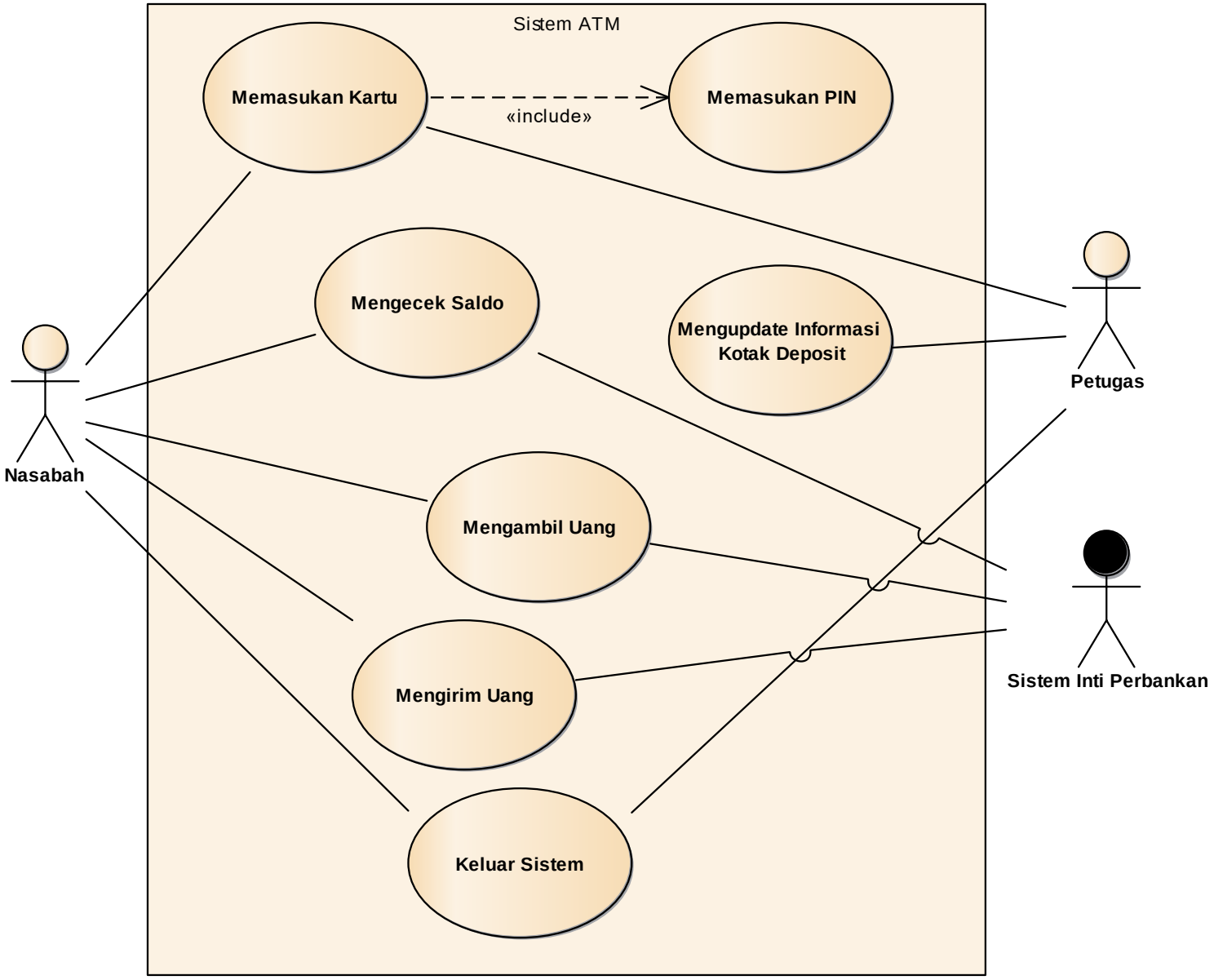
2.3.1 Activity Diagram

Activity Diagram Syntax

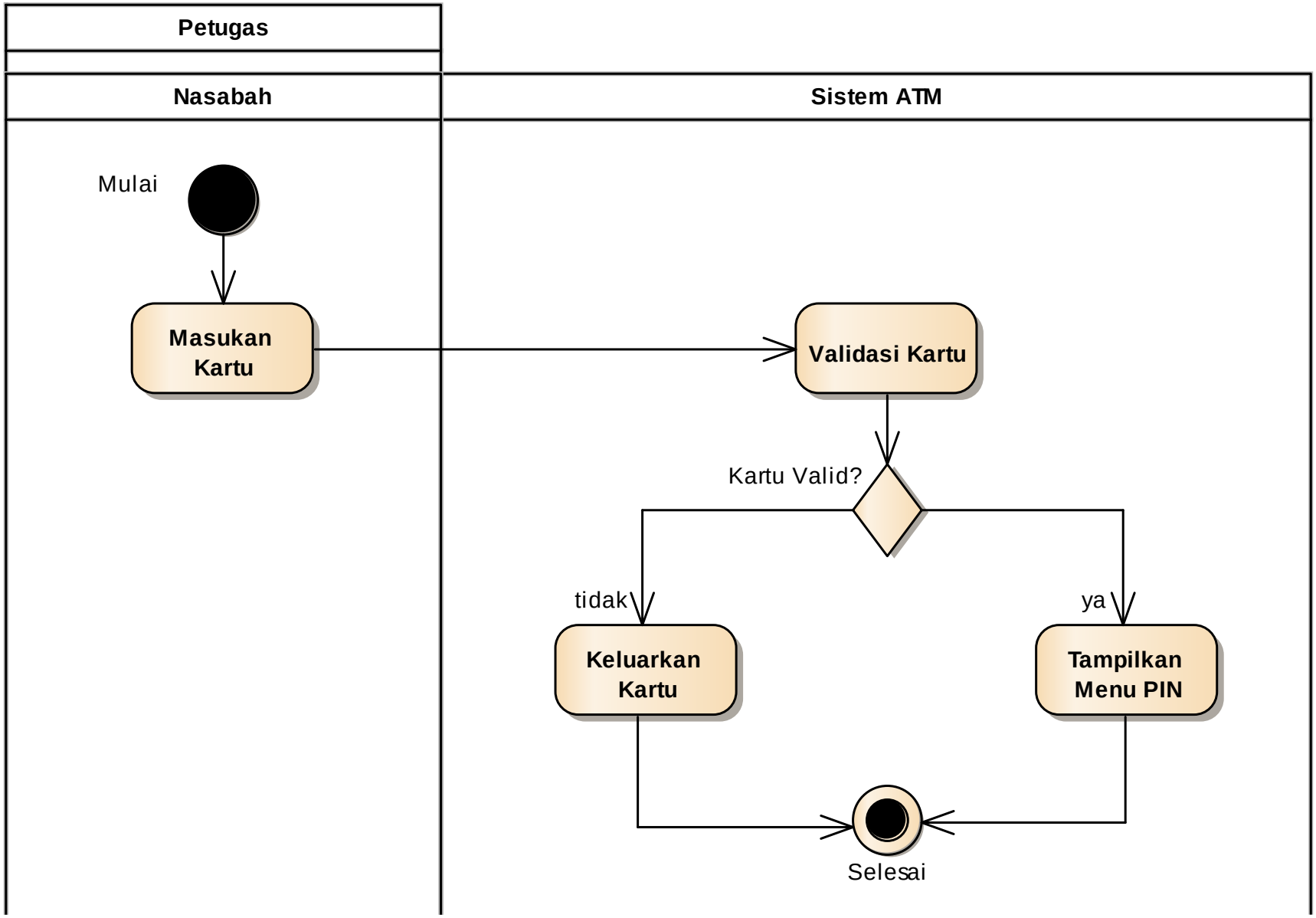
An action: ■ Is a simple, nondecomposable piece of behavior. ■ Is labeled by its name.	
An activity: ■ Is used to represent a set of actions. ■ Is labeled by its name.	
An object node: ■ Is used to represent an object that is connected to a set of object flows. ■ Is labeled by its class name.	
A control flow: ■ Shows the sequence of execution.	
An object flow: ■ Shows the flow of an object from one activity (or action) to another activity (or action).	
An initial node: ■ Portrays the beginning of a set of actions or activities.	
A final-activity node: ■ Is used to stop all control flows and object flows in an activity (or action).	
A final-flow node: ■ Is used to stop a specific control flow or object flow.	
A decision node: ■ Is used to represent a test condition to ensure that the control flow or object flow only goes down one path. ■ Is labeled with the decision criteria to continue down the specific path.	
A merge node: ■ Is used to bring back together different decision paths that were created using a decision node.	
A fork node: Is used to split behavior into a set of parallel or concurrent flows of activities (or actions)	
A join node: Is used to bring back together a set of parallel or concurrent flows of activities (or actions)	
A swimlane: Is used to break up an activity diagram into rows and columns to assign the individual activities (or actions) to the individuals or objects that are responsible for executing the activity (or action) Is labeled with the name of the individual or object responsible	

Studi Kasus: Activity Diagram Sistem ATM

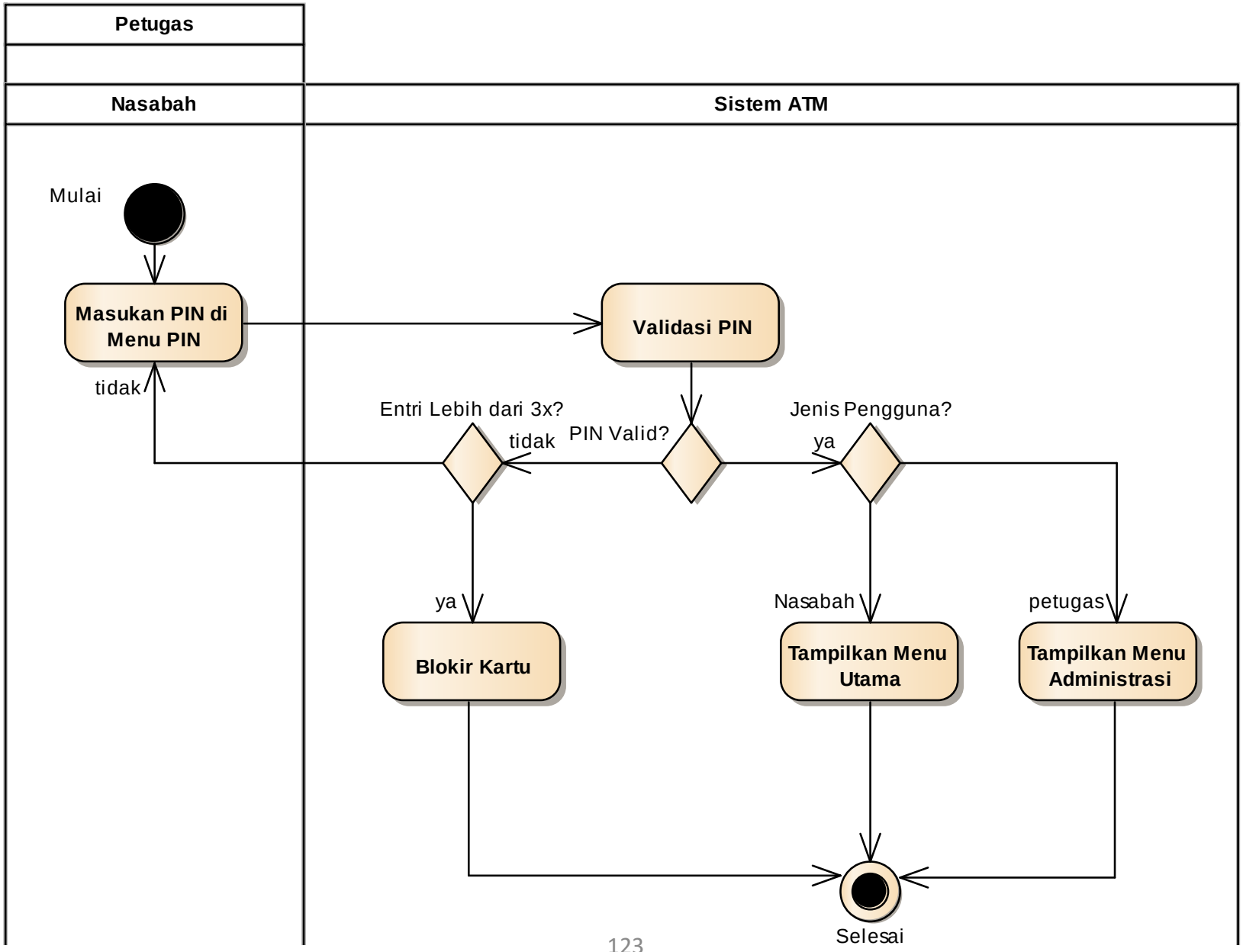
Use Case Diagram Sistem ATM



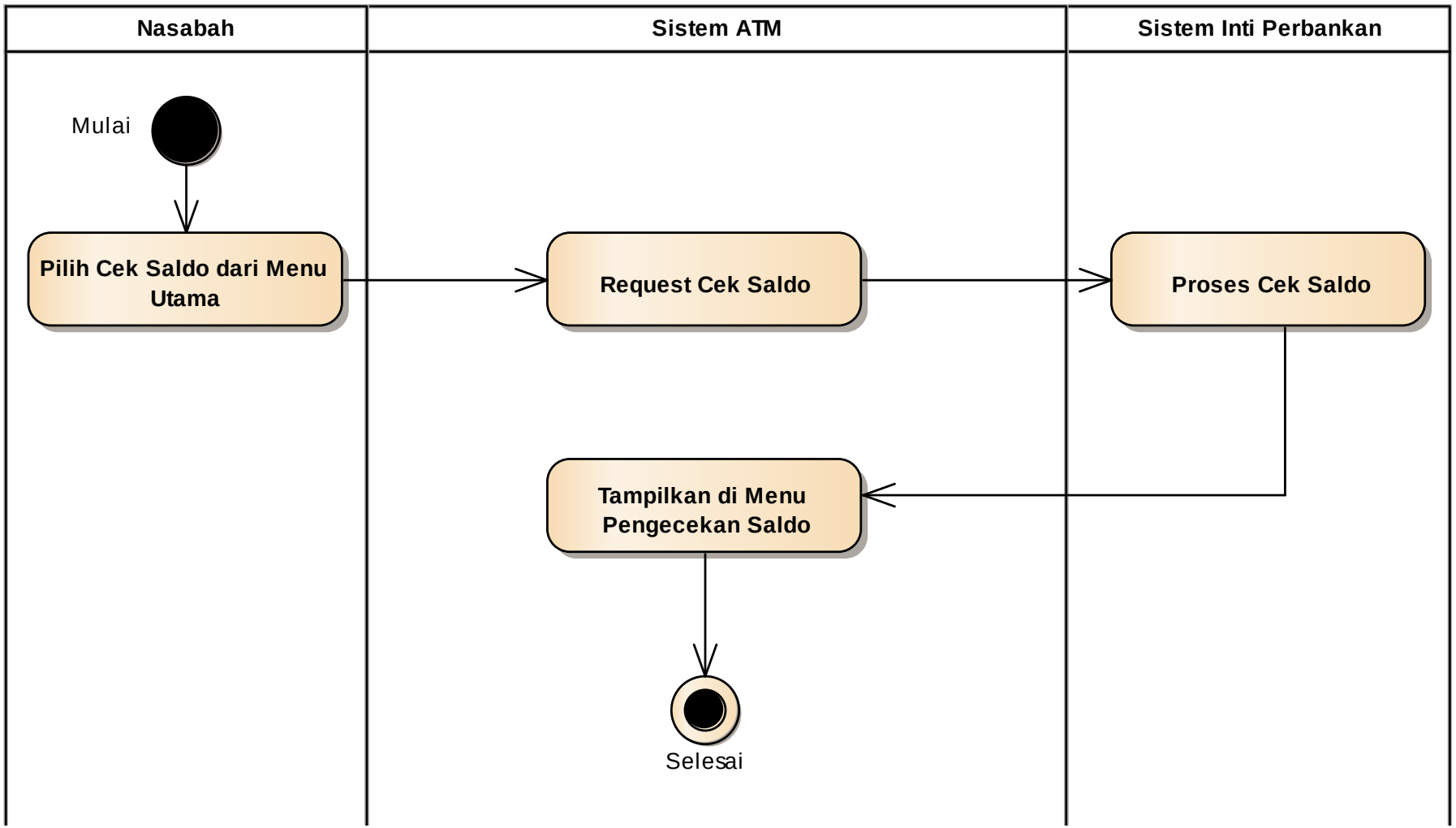
Activity Diagram: Memasukkan Kartu



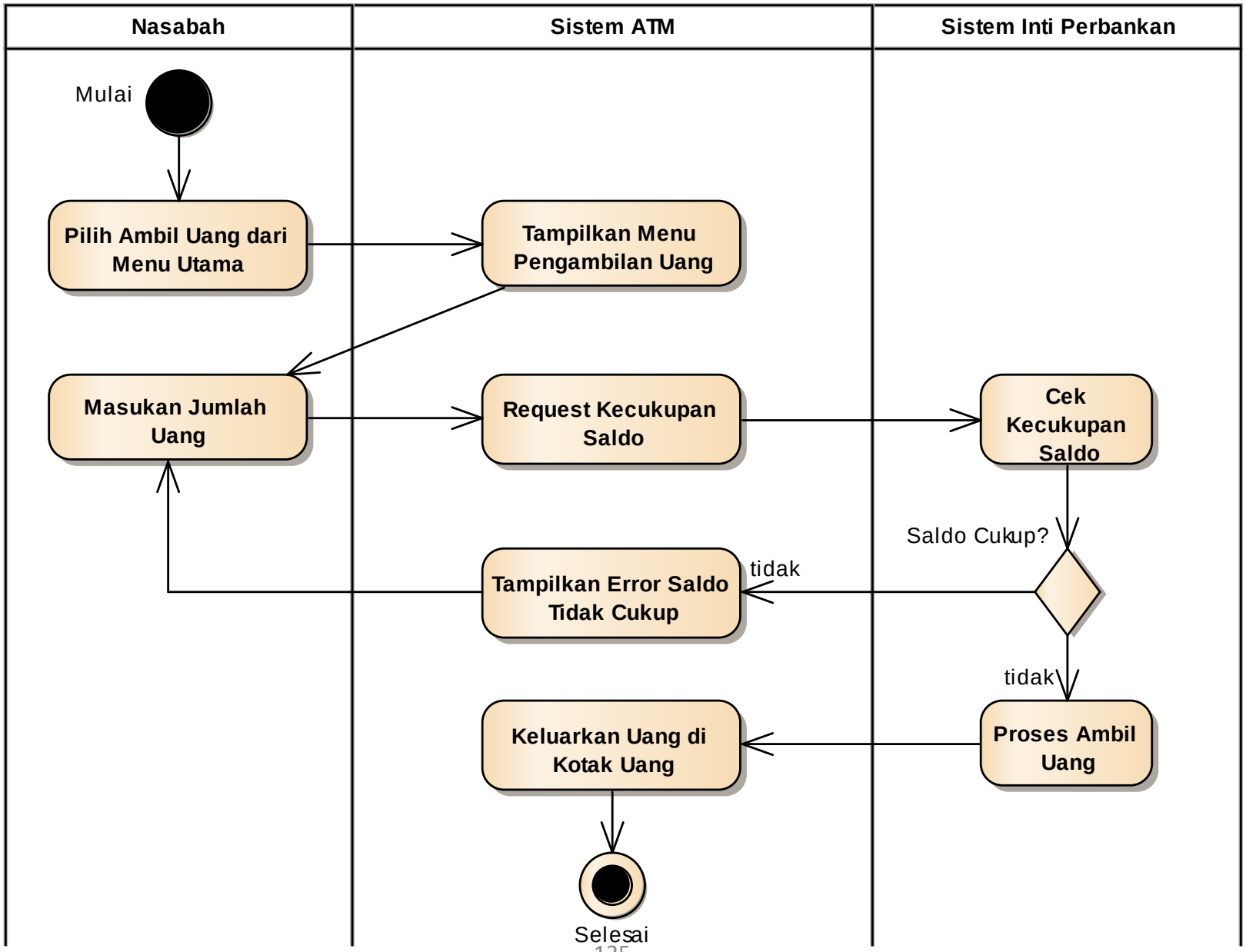
Activity Diagram: Memasukkan PIN



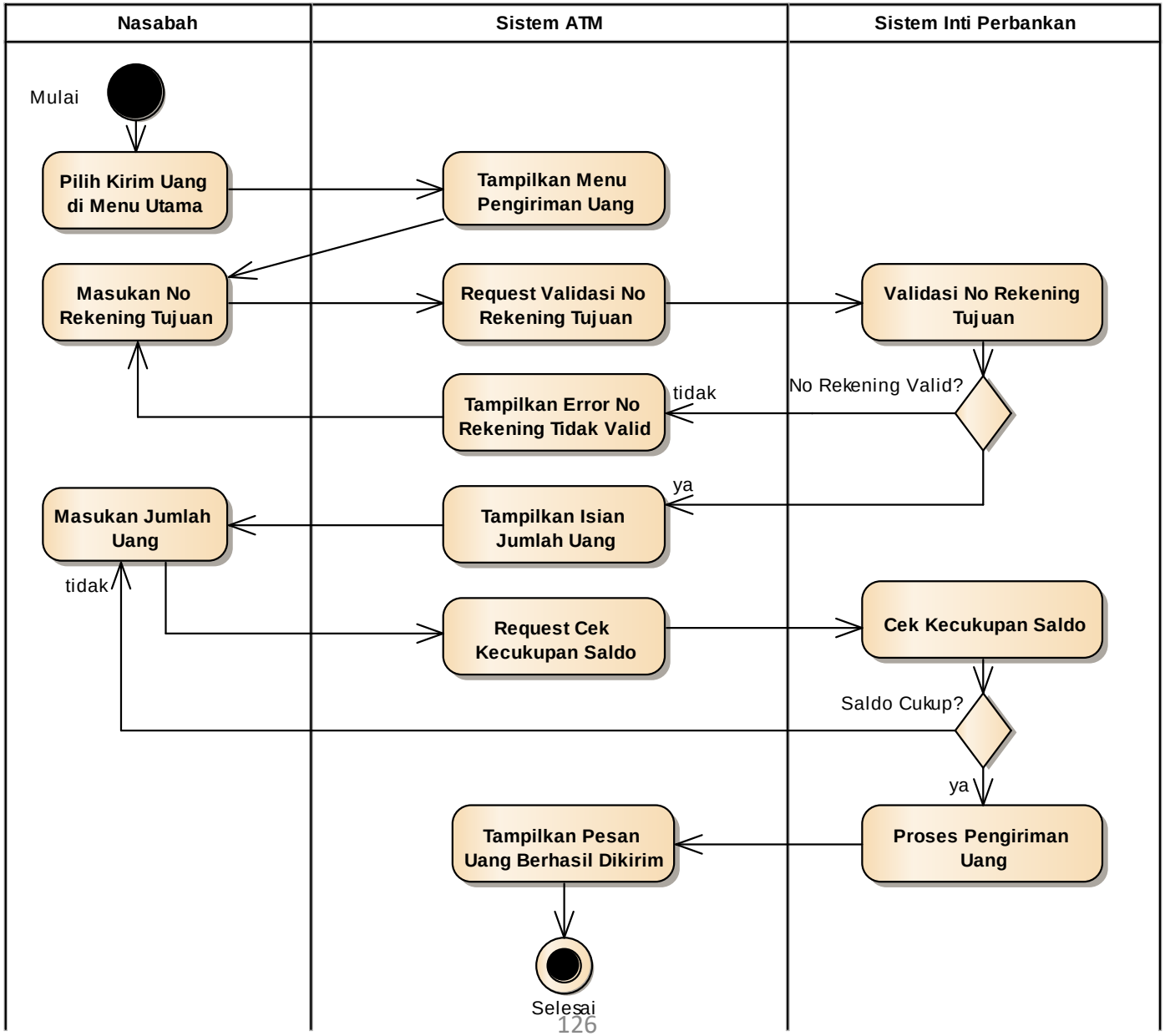
Activity Diagram: Mengecek Saldo



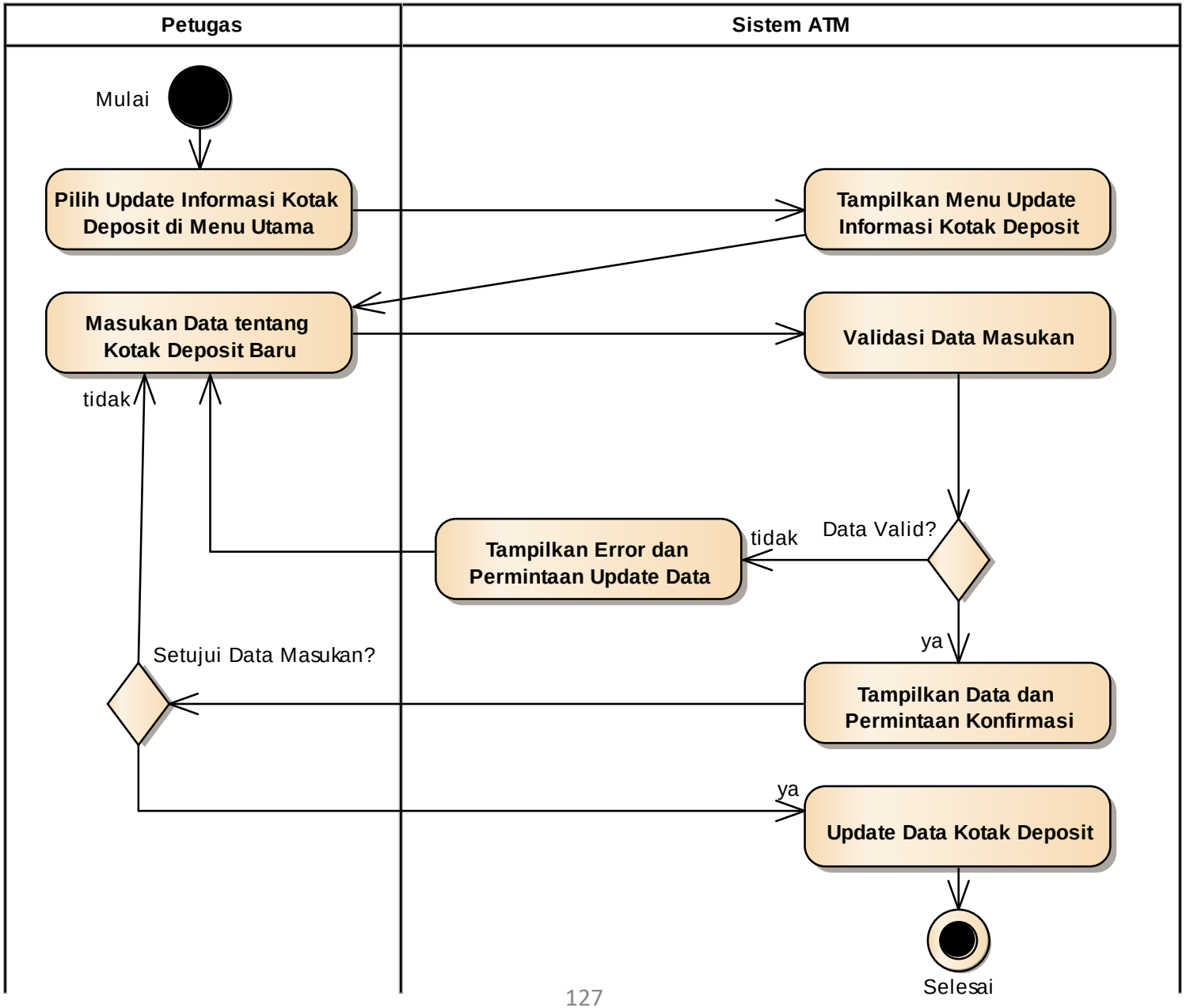
Activity Diagram: Mengambil Uang



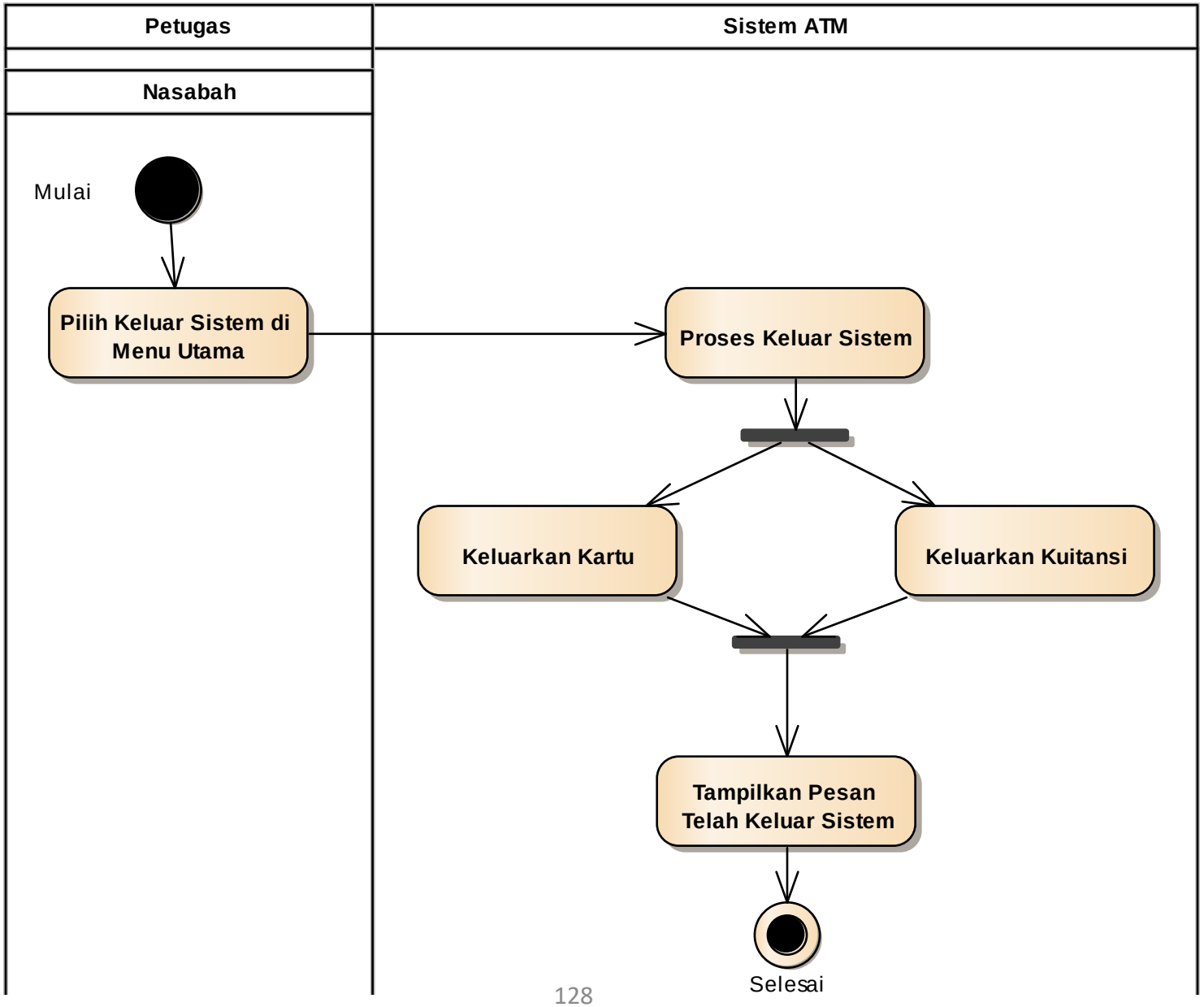
Activity Diagram: Mengirim Uang



Activity Diagram: Mengupdate Informasi Kotak Deposit

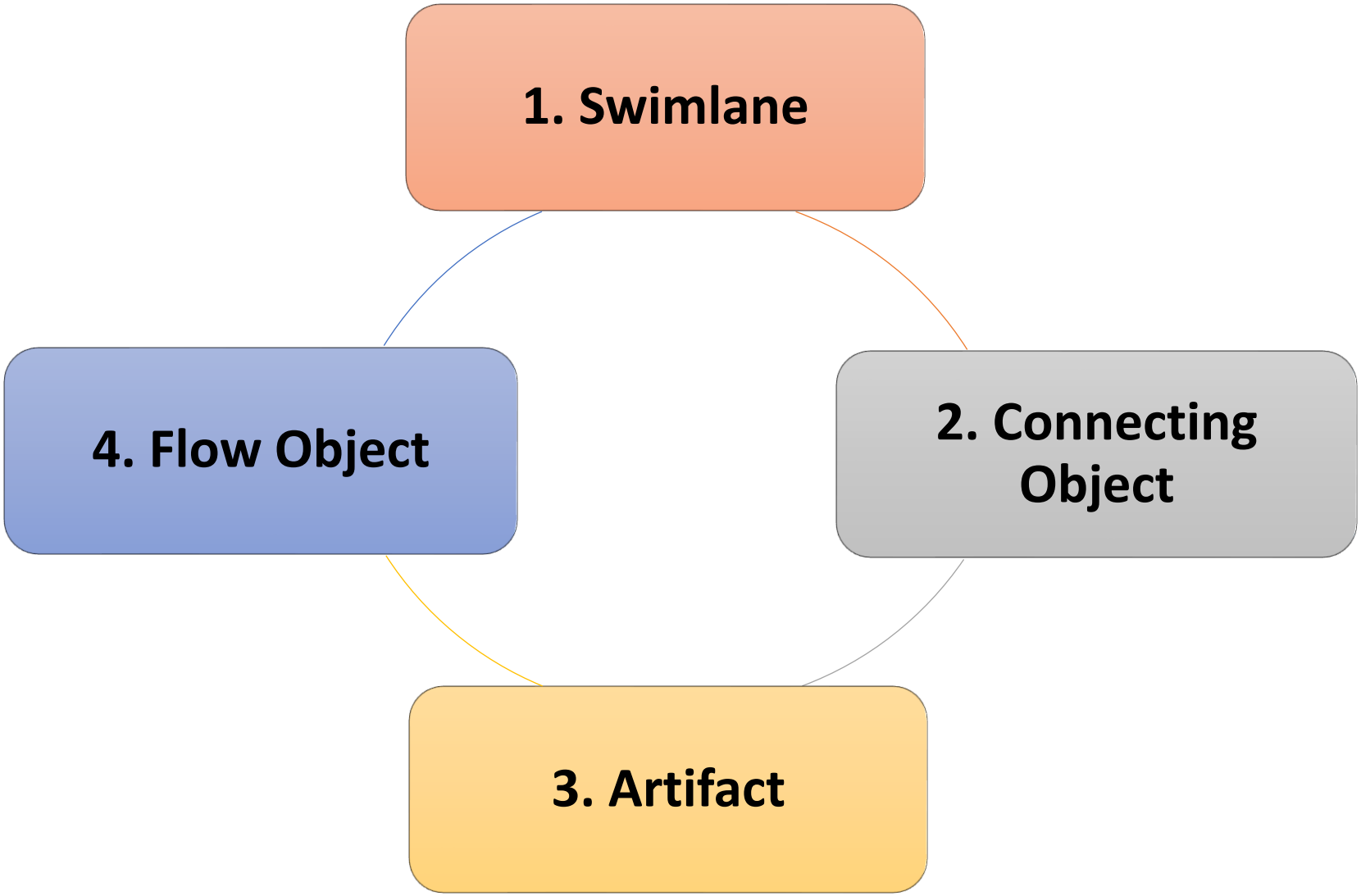


Activity Diagram: Keluar Sistem



2.3.2 Business Process Model and Notation (BPMN)

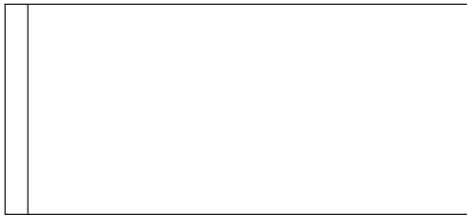
Elemen BPMN



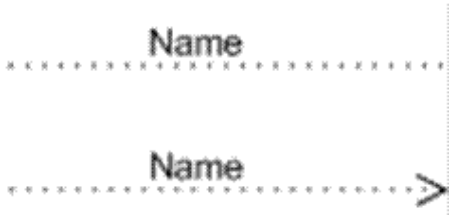
Elemen dan Notasi BPMN

ELEMEN	DESKRIPSI	NAMA NOTASI
Swimlane	Mekanisme untuk mengatur dan memisahkan peran atau penanggungjawab dari suatu proses	**Pool**
		Lane
Connecting Object	Konektor dari obyek yang mengalir pada suatu proses	**Sequence Flow**
		Message Flow
		Association
Artifact	Informasi tambahan dalam suatu proses	**Annotation**
		Group
		Data Object
		Data Store
Flow Object	Obyek yang mengalir pada suatu proses	**Event**
		Activity
		Gateway

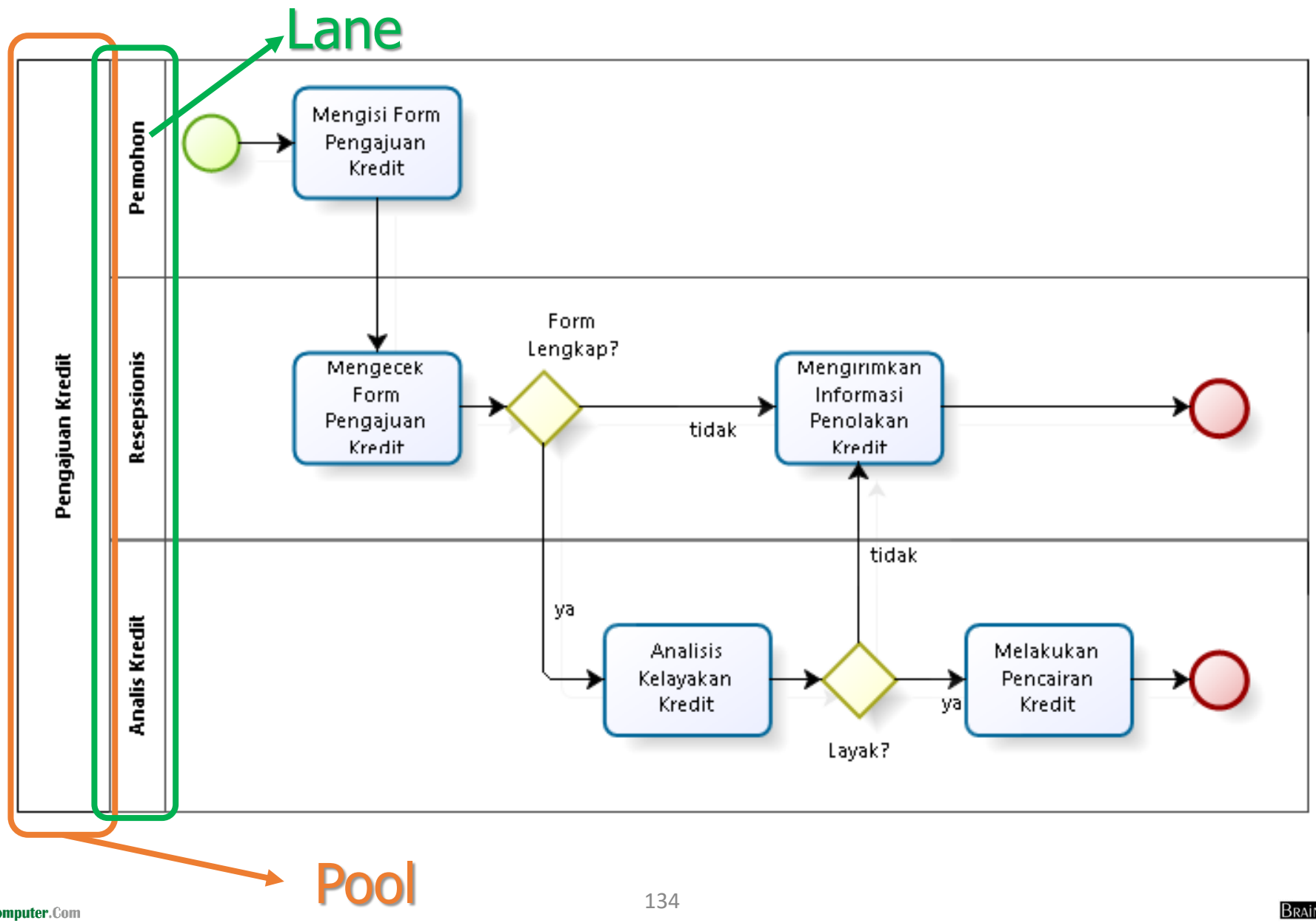
Swimlane

Nama Notasi	Deskripsi	Notasi
Pool	Kontainer dari satu proses	
Lane	Partisi dari suatu proses, yang menunjukkan sub organisasi, jabatan, peran atau penanggungjawab	

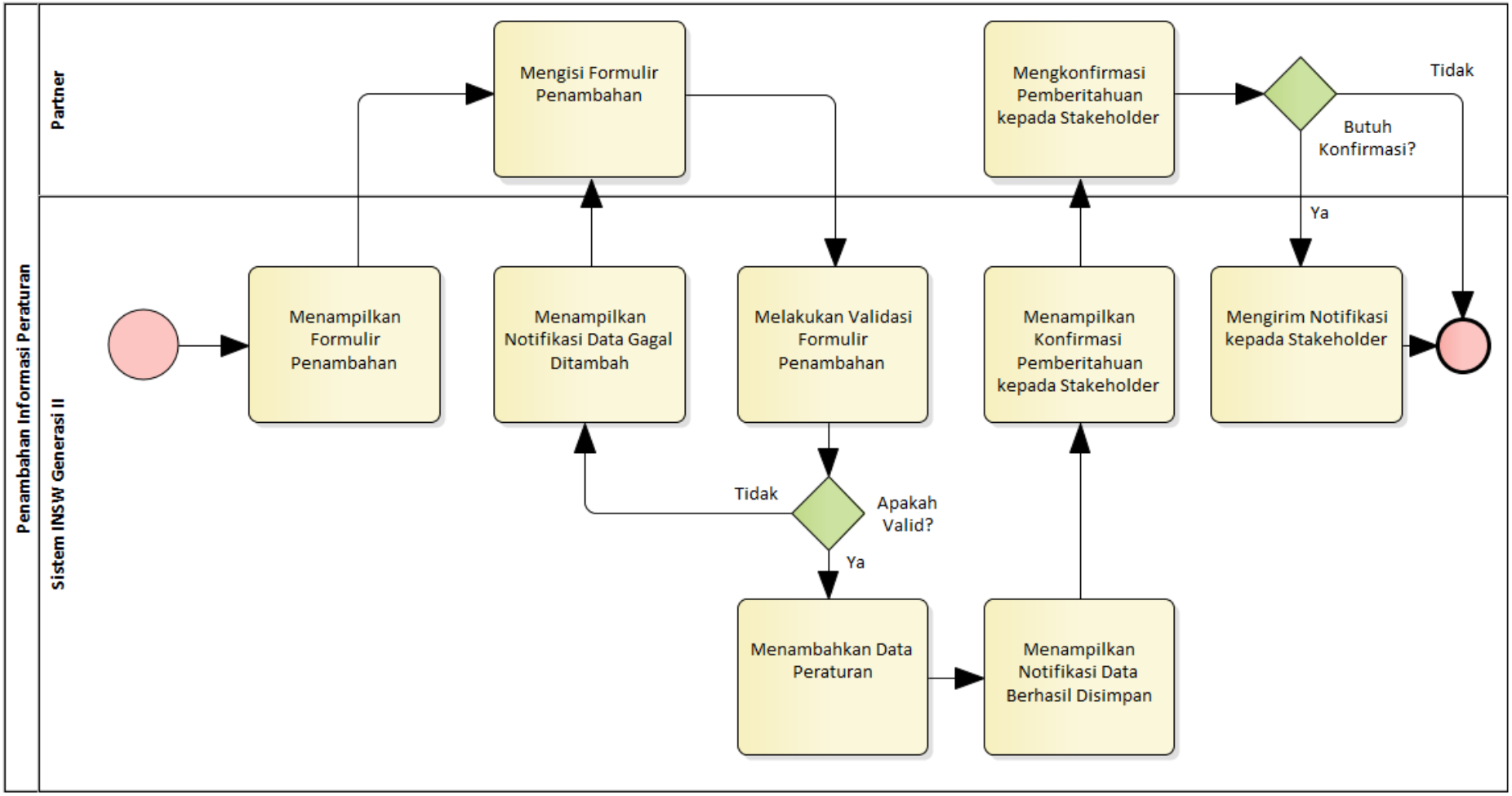
Connecting Object

NAMA NOTASI	DESKRIPSI	NOTASI
Sequence Flow	Konektor yang menghubungkan antar obyek yang mengalir dalam satu proses (satu pool)	
Message Flow	Konektor yang menghubungkan antar obyek yang mengalir antar proses (beda pool)	
Association	Konektor yang menghubungkan obyek yang mengalir ke artifact	

Swimlane - Proses Bisnis Organisasi



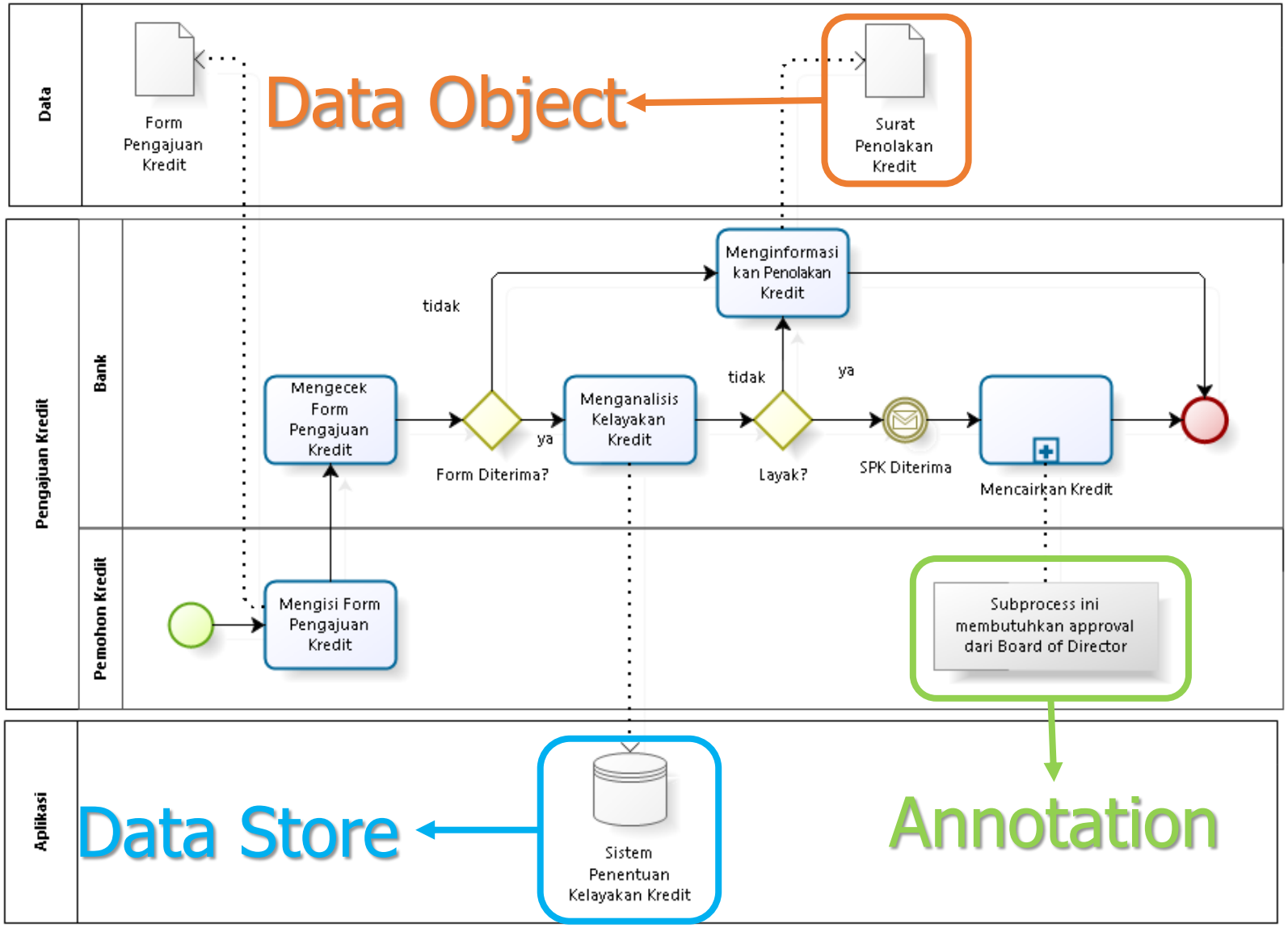
Swimlane - Proses Bisnis Sistem



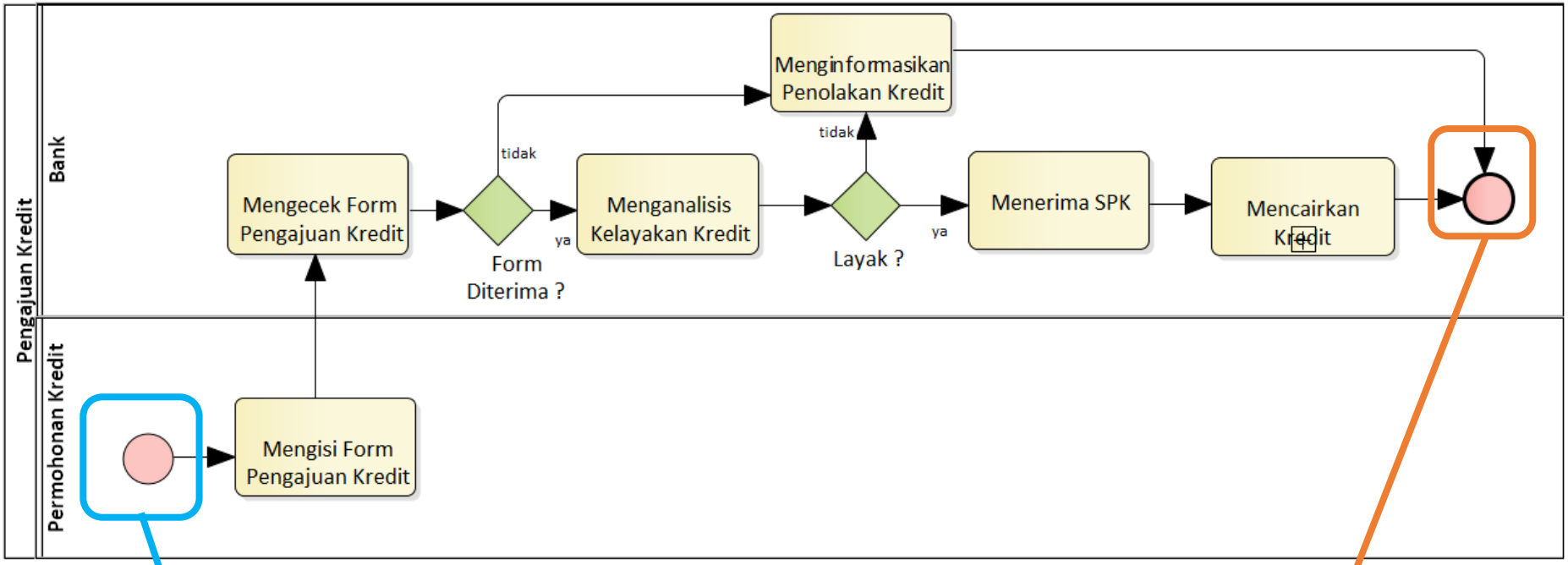
Artifact

NAMA NOTASI	DESKRIPSI	NOTASI
Annotation	Penjelasan dari suatu obyek yang mengalir	
Group	Pengelompokan dari beberapa obyek yang mengalir	
Data Object	File dan dokumen yang digunakan dan dihasilkan oleh suatu aktifitas	
Data Store	Sistem dan aplikasi yang digunakan dan dihasilkan oleh suatu aktifitas	

Annotation, Data Object dan Data Store



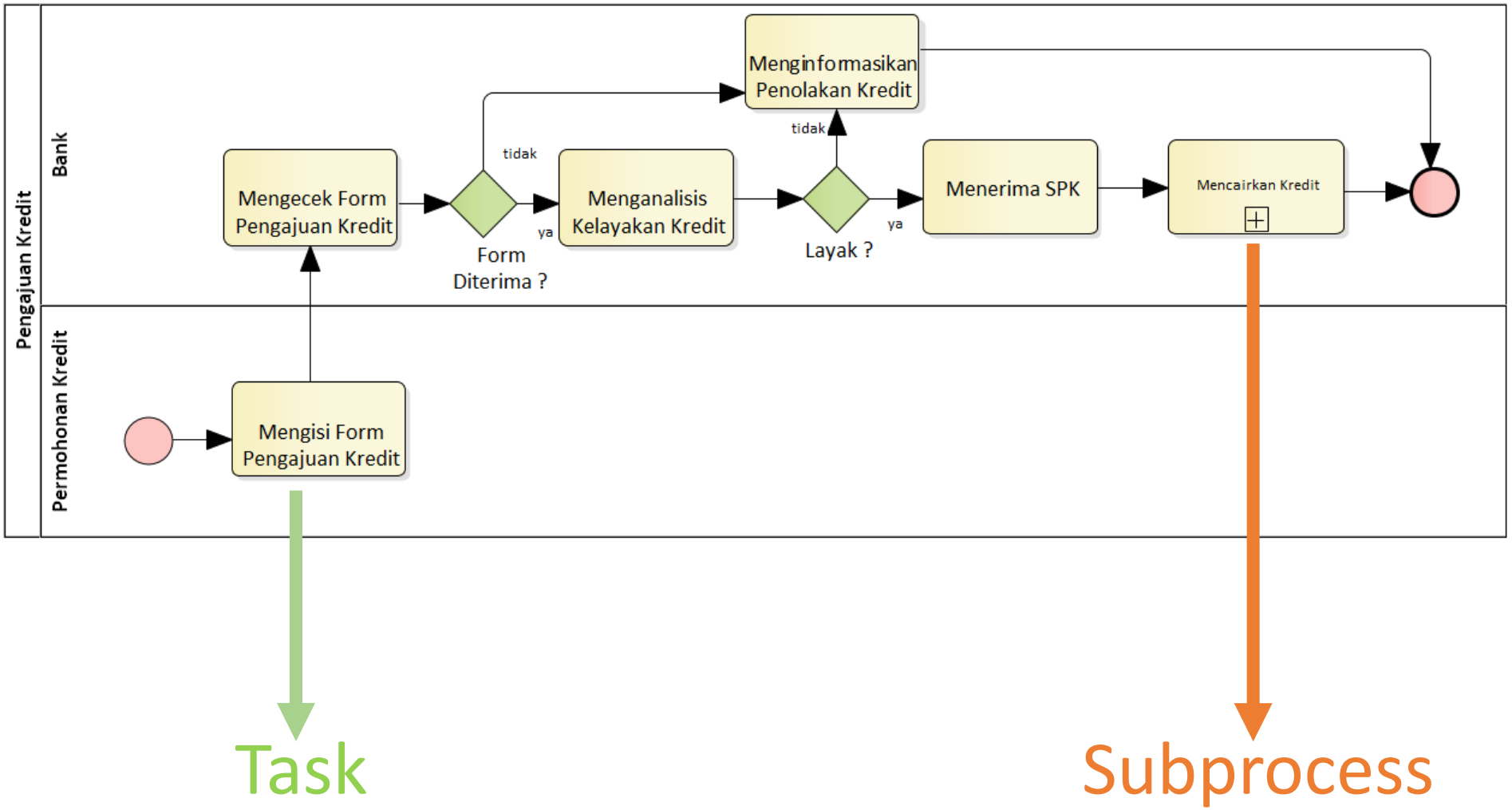
Event



Start Event

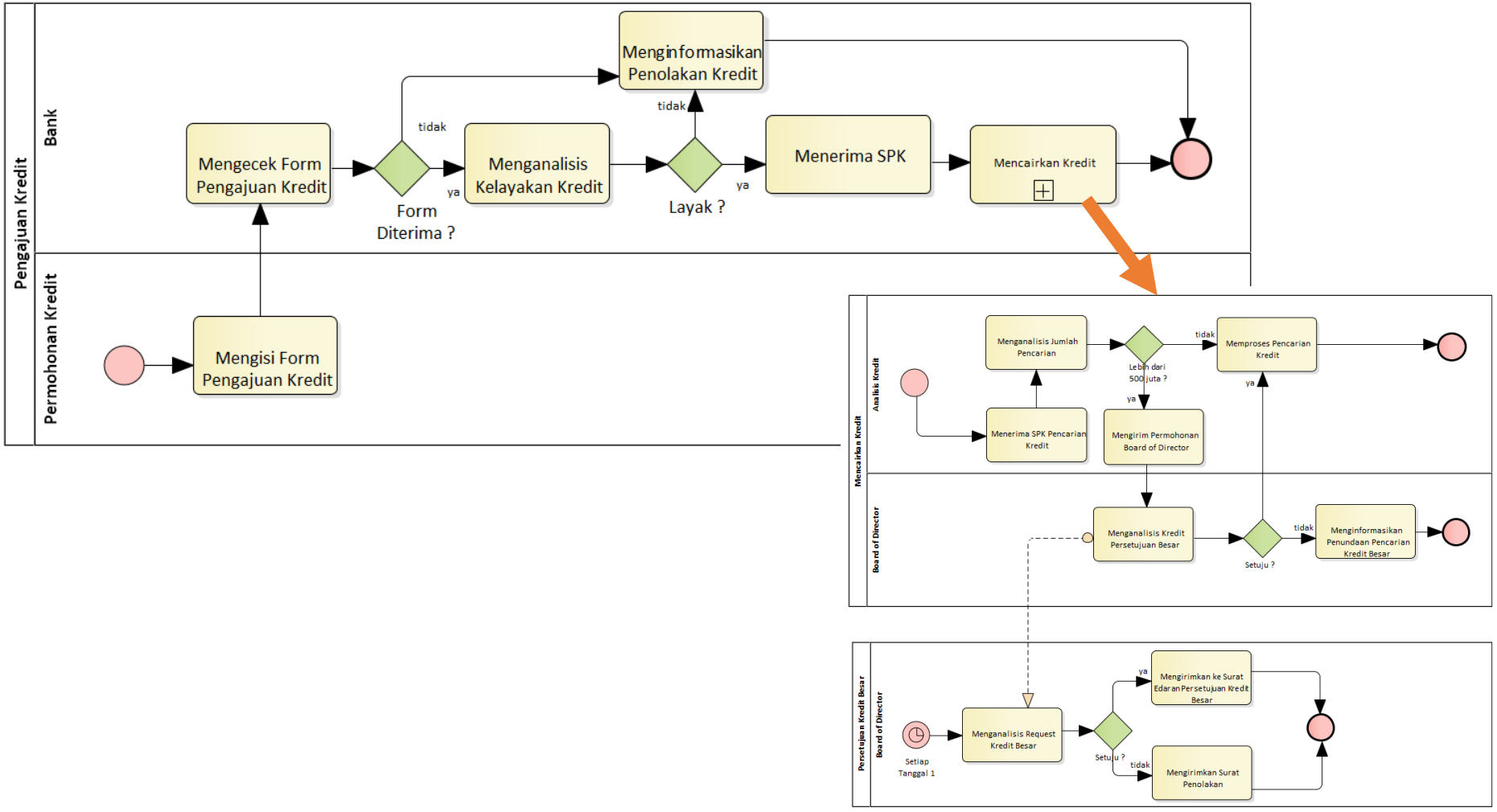
End Event

Activity


Pengajuan Kredit
Bank
Permohonan Kredit
Menginformasikan Penolakan Kredit
tidak
tidak
Mengecek Form Pengajuan Kredit
Form Diterima ?
ya
Menganalisis Kelayakan Kredit
Layak ?
ya
Menerima SPK
Mencairkan Kredit
Mengisi Form Pengajuan Kredit
Task
Subprocess

Subprocess

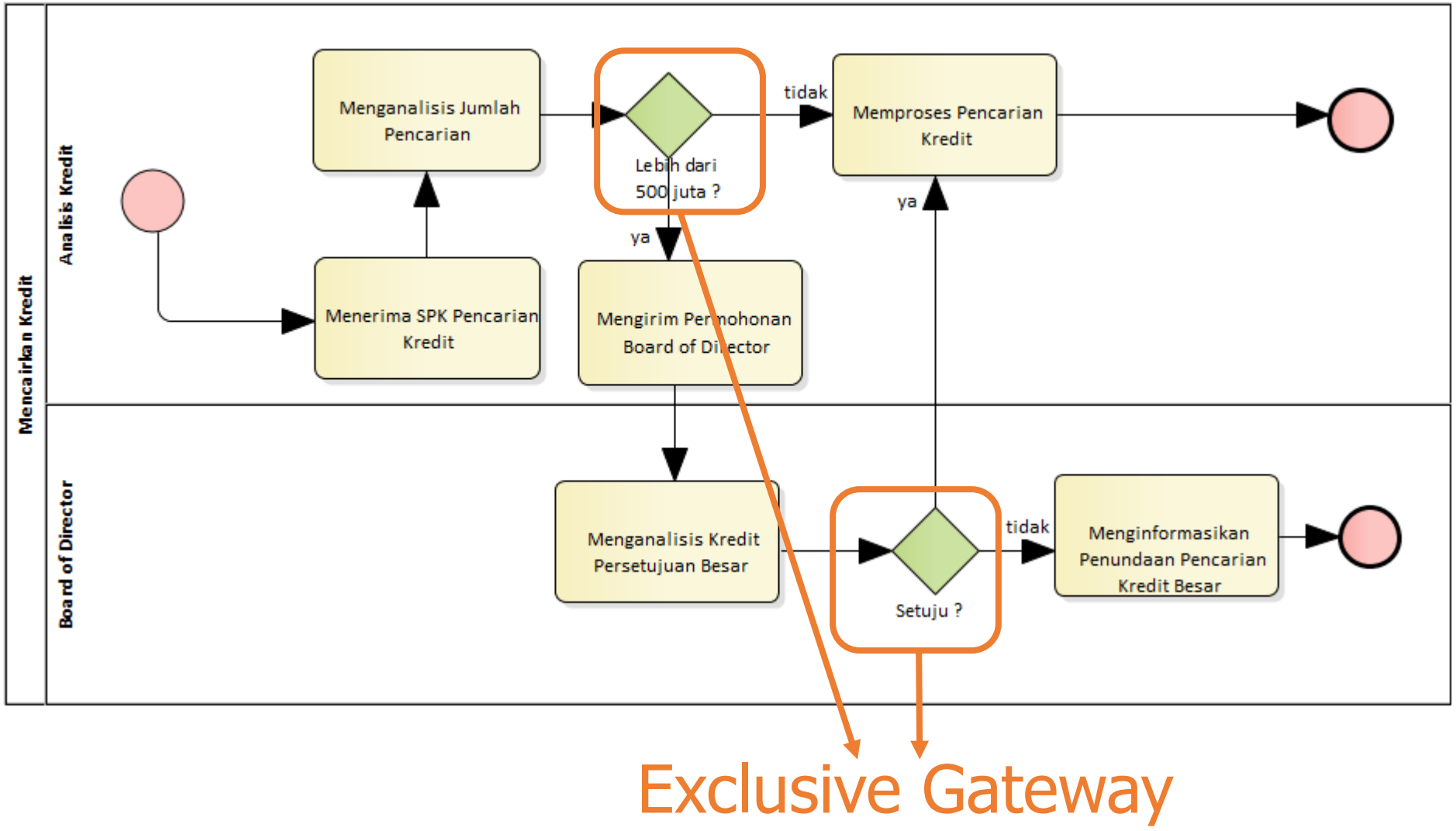
Leveling pada proses bisnis menggunakan BPMN menggunakan subprocess



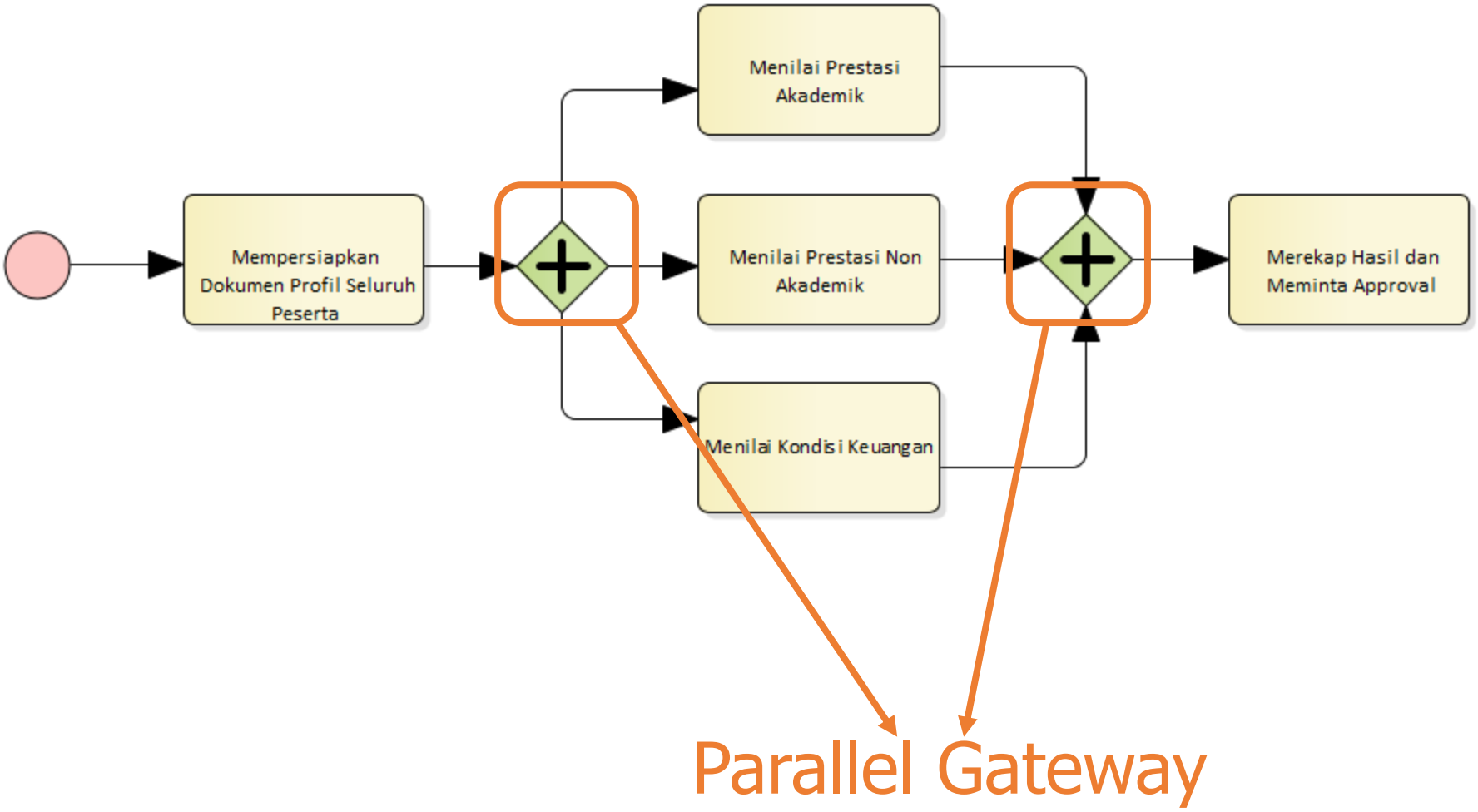
Gateway

Nama Notasi	Deskripsi	Notasi
Exclusive Gateway	Pilih salah satu	
Parallel Gateway	Kegiatan bersamaan (paralel) dalam satu waktu	

Exclusive Gateway



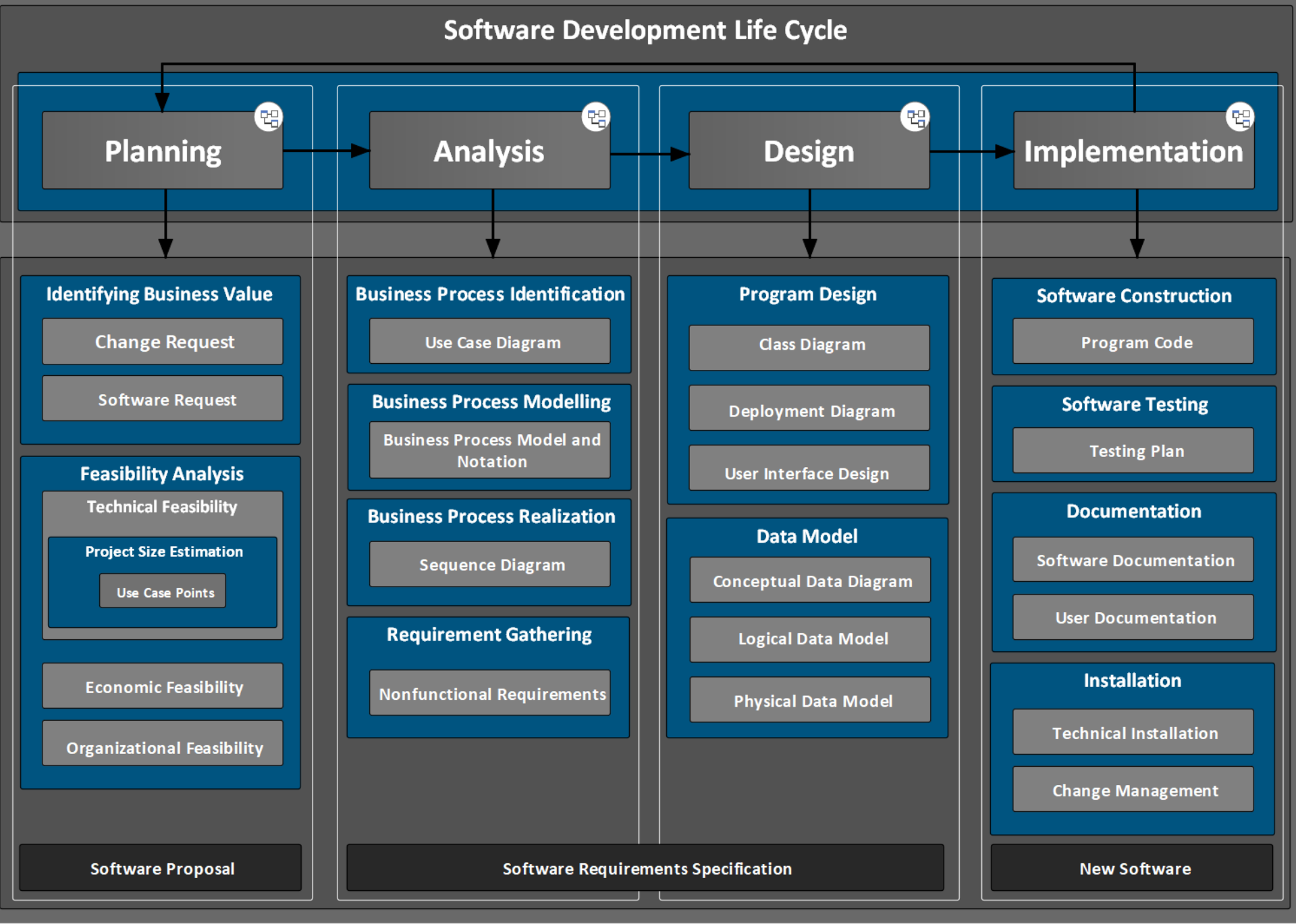
Parallel Gateway



Studi Kasus: BPMN MusicPedia

User Interface Diagram langsung digambarkan (prototyping) untuk mempermudah pengguna memahami konteks dari alur proses berjalannya software

Application Development Governance



Software Request

musicpedia				
Date	26 Oktober 2018			
Description	Musicpedia adalah aplikasi layanan download musik & audio dimana saja dan kapan saja, menawarkan akses lengkap ke jutaan lagu dari semua artis papan atas di industri musik barat maupun musik lokal, mendengarkan musik baru dan top musik dunia dalam bentuk audio mp3 secara offline			
Project Sponsor	Wahyu Utomo, VP Business Development, PT Musika Indonesia			
Business Need	1. Tidak Setuju	2. Ragu-Ragu	3. Setuju	4. Sangat Setuju
Aplikasi yang dikembangkan mampu meningkatkan pendapatan perusahaan?	☐	☐	☐	☑
Aplikasi yang dikembangkan mampu mengurangi biaya operasional perusahaan?	☐	☐	☑	☐
Aplikasi yang dikembangkan mampu meningkatkan produktifitas kerja pegawai?	☐	☑	☐	☐
Aplikasi yang dikembangkan mampu meningkatkan nilai tambah perusahaan yang bersifat intangible?	☐	☐	☑	☐
Business Value	Intangible Value: a. Meningkatkan brand recognition perusahaan di dunia internet b. Meningkatkan produktivitas kerja pegawai dan mengurangi kuantitas pegawai Tangible Value: a. Mengurangi biaya operasional perusahaan: - Sewa ruangan: Rp120.000.000,- - Biaya komunikasi: Rp6.000.000,- b. Meningkatkan penjualan musik: Rp400.000.000,-			

Technical Feasibility

musicpedia				
Date: 26 Oktober 2018				
Penjelasan isian	1. Sangat Kurang	2. Kurang	3. Baik	4. Sangat Baik

Kefamiliaran dengan Aplikasi	1	2	3	4
Pengguna familiar terhadap pengoperasian aplikasi ini.	☐	☐	☑	☐
Pengembang familiar terhadap pengembangan aplikasi ini.	☐	☐	☐	☑
Kefamiliaran dengan Teknologi	**1**	**2**	**3**	**4**
Pengguna familiar dengan teknologi pendukung aplikasi.	☐	☑	☐	☐
Pengembang familiar mengembangkan aplikasi dengan platform, bahasa pemrograman dan tool IDE yang dipilih.	☐	☐	☐	☑
Ukuran Proyek				
Jumlah pengembang yang dibutuhkan.	7 Man/Month			
Waktu yang dibutuhkan dalam mengembangkan aplikasi ini.	6 Month			
Kompatibilitas	**1**	**2**	**3**	**4**
Kebutuhan pengguna terhadap kompatibilitas aplikasi untuk terintegrasi dengan aplikasi lain.	☐	☐	☑	☐
Kompatibilitas aplikasi terhadap teknologi yang ada pada organisasi.	☐	☐	☐	☑

Secara analisi kelayakan teknis, apakah aplikasi layak dikembangkan sesuai kriteria di atas?	☑ Layak	☐ Tidak Layak

Technical Feasibility

Use Case Points

Tahap 1 - Menghitung Person Hours (PH)				
Use Case Points (UCP)		Person Hours Multiplier (PHM)	Person Hours (PH)	
51		20	1020	
51		28	1428	
Tahap 2 - Menghitung Person Month (PM)				
PHM	Person Hours (PH)	Lama Bekerja Perhari	Jumlah Bekerja Sebulan	Person Months (PM)
20	1020	8	22	5.80
	1020	10	26	3.92
28	1428	8	22	8.11
	1428	10	26	5.49
Tahap 3 - Menghitung Time (Month)				
PHM	Formula Penghitung Waktu		Jumlah Bekerja Sebulan	Waktu dalam Bulan (M)
20	3 * PM^(1/3)		22	5.39
			26	4.73
28			22	6.03
			26	5.29

Economic Feasibility

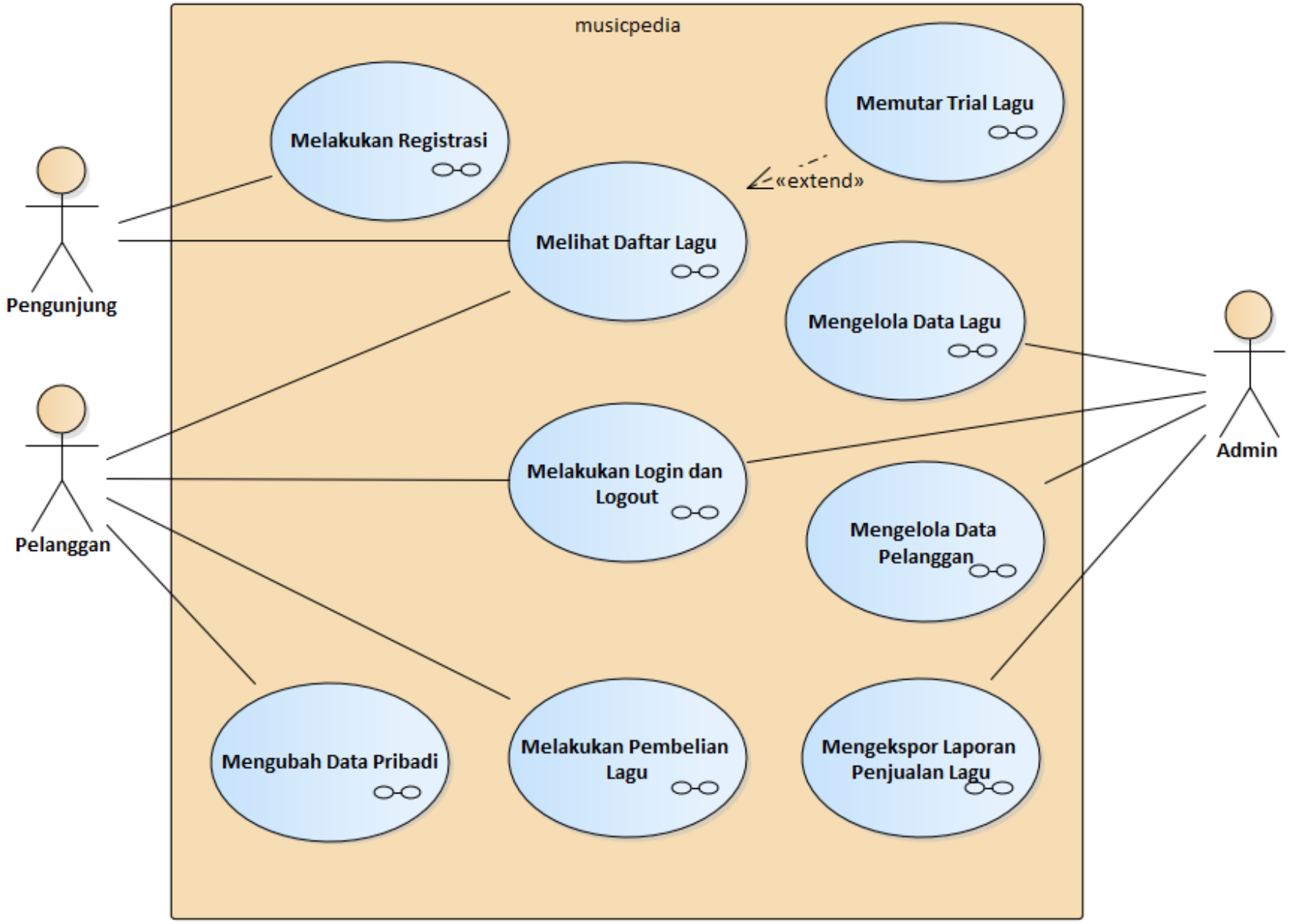
Cost-Benefit Analysis

Tahun	2019	2020	2021	2022
Peningkatan Pendapatan Penjualan Lagu		400,000,000	400,000,000	400,000,000
Pengurangan Biaya Sewa Ruangan		120,000,000	120,000,000	120,000,000
Pengurangan Biaya Komunikasi		6,000,000	6,000,000	6,000,000
Total Benefits	**0**	**526,000,000**	**526,000,000**	**526,000,000**
PV of Benefits	**0**	**468,138,127**	**441,639,743**	**416,641,267**
PV of All Benefits	**0**	**468,138,127**	**909,777,870**	**884,779,394**
Honor Tim (Analysis, Design and Implementation)	250,000,000	120,000,000	120,000,000	120,000,000
Total Development Costs	**250,000,000**	**120,000,000**	**120,000,000**	**120,000,000**
Honor Pengelola Web	72,000,000	72,000,000	72,000,000	72,000,000
Biaya Lisensi Software	10,000,000	10,000,000	10,000,000	10,000,000
Hardware upgrades	50,000,000	50,000,000	50,000,000	50,000,000
Biaya Komunikasi	1,000,000	1,000,000	1,000,000	1,000,000
Biaya Marketing	50,000,000	50,000,000	50,000,000	50,000,000
Total Operational Costs	**183,000,000**	**183,000,000**	**183,000,000**	**183,000,000**
Total Costs	**433,000,000**	**303,000,000**	**303,000,000**	**303,000,000**
PV of Costs	**408,490,566**	**269,668,921**	**153,650,329**	**144,953,140**
PV of all Costs	**408,490,566**	**678,159,487**	**831,809,816**	**976,762,957**
Total Project Costs Less Benefits	**-433,000,000**	**223,000,000**	**223,000,000**	**223,000,000**
Yearly NPV	**-408,490,566**	**198,469,206**	**187,235,100**	**176,636,887**
Cumulative NPV	**-408,490,566**	**-210,021,360**	**-22,786,260**	**153,850,627**
Return on Investment (ROI)	**-100.00%**	**-0.309693168**	**-0.027393593**	**0.15751071**
Break-even Point (BEP)				**3.129000574**

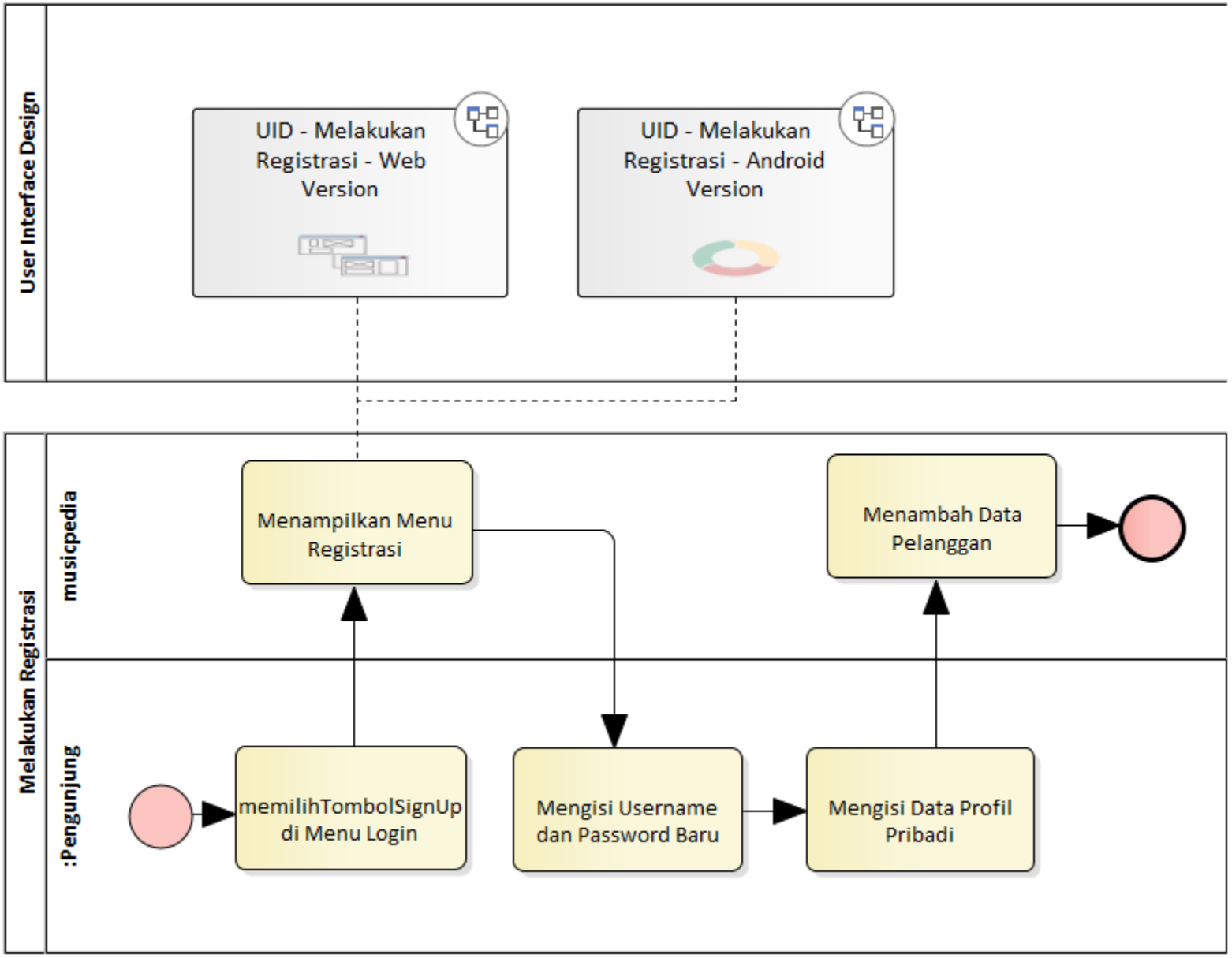
Organizational Feasibility

musicpedia			
Date	**26 Oktober 2018**		
Anggota Tim			
User/Product Owner	Wahyu Utomo		
Project Manager	Haris Dermawan		
System Analyst	Risa Dhani Horasman Purba		
Business Analyst	Mulyana		
Programmer	Achmad Fatkarrofiqi		
Tester	Januar Sapareza		
Apakah aplikasi ini mendukung visi dan misi organisasi?			
Ya			
Apakah aplikasi ini sesuai dengan tugas, fungsi dan KPI unit kerja anda?			
Ya			
Apakah aplikasi ini selaras dengan proses bisnis unit kerja anda?			
Ya			
Secara analisis kelayakan organisasi, apakah aplikasi layak dikembangkan sesuai kriteria di atas?		☑ Layak	☐ Tidak Layak

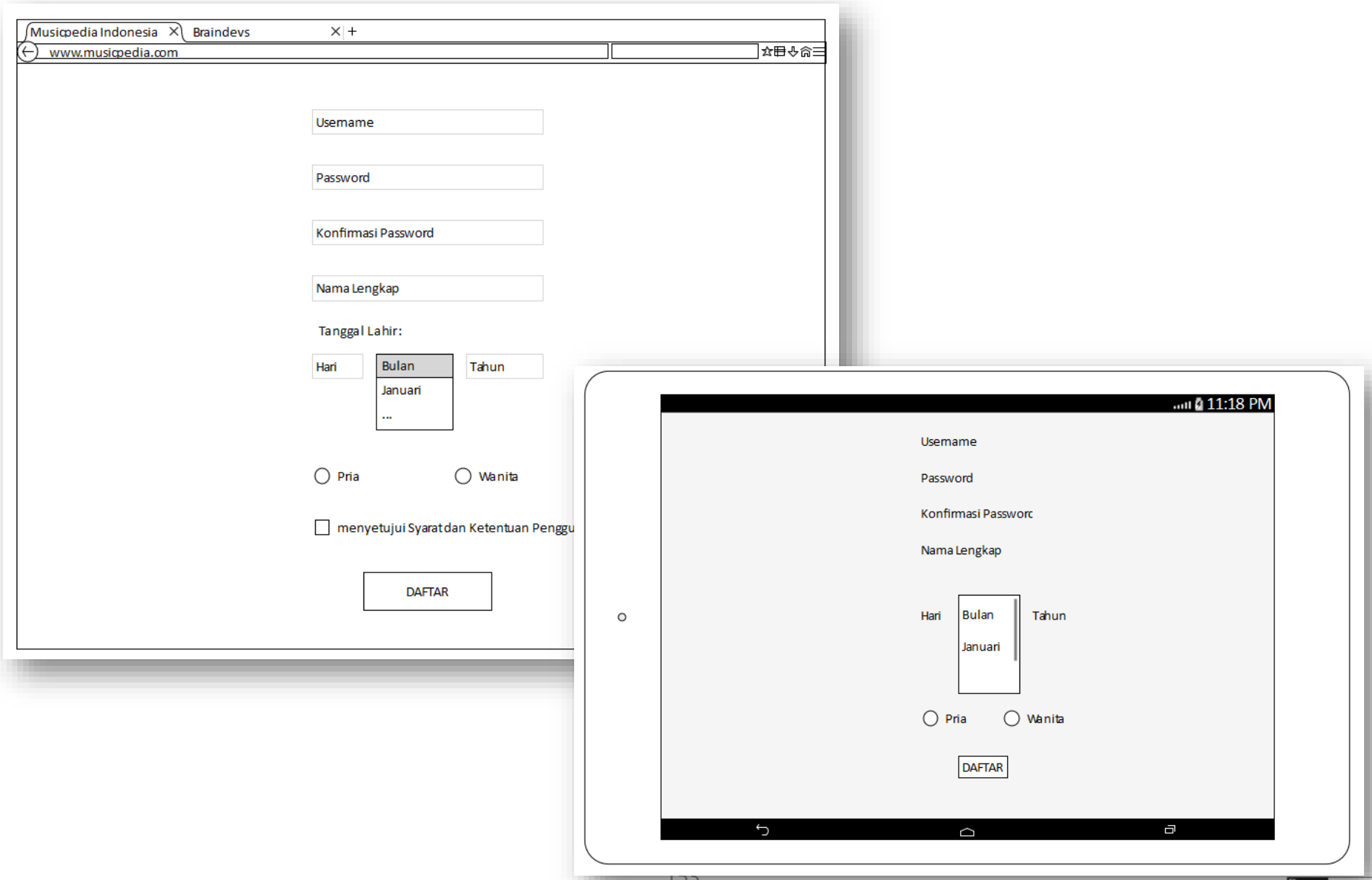
Use Case Diagram MusicPedia



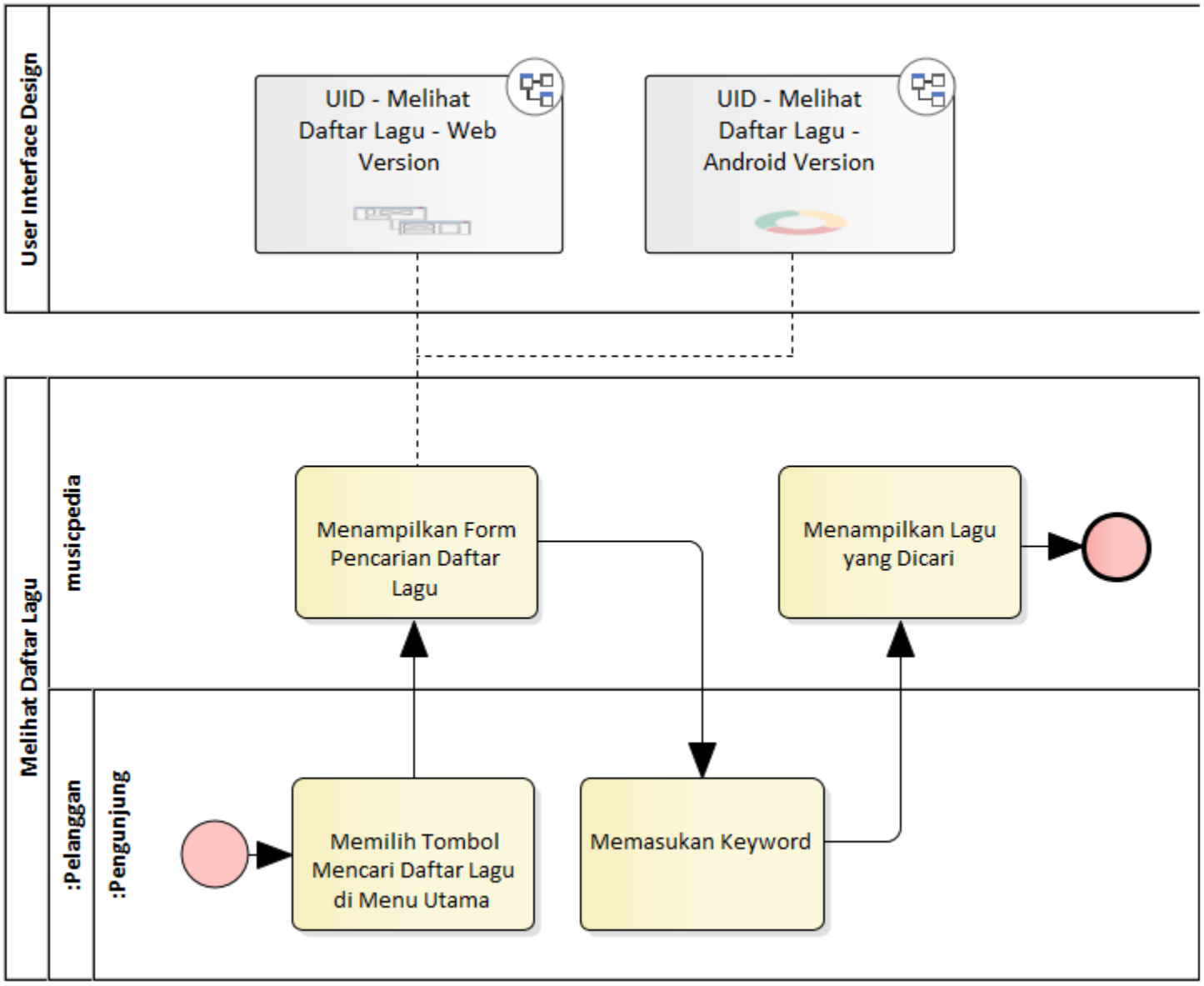
BPMN Melakukan Registrasi



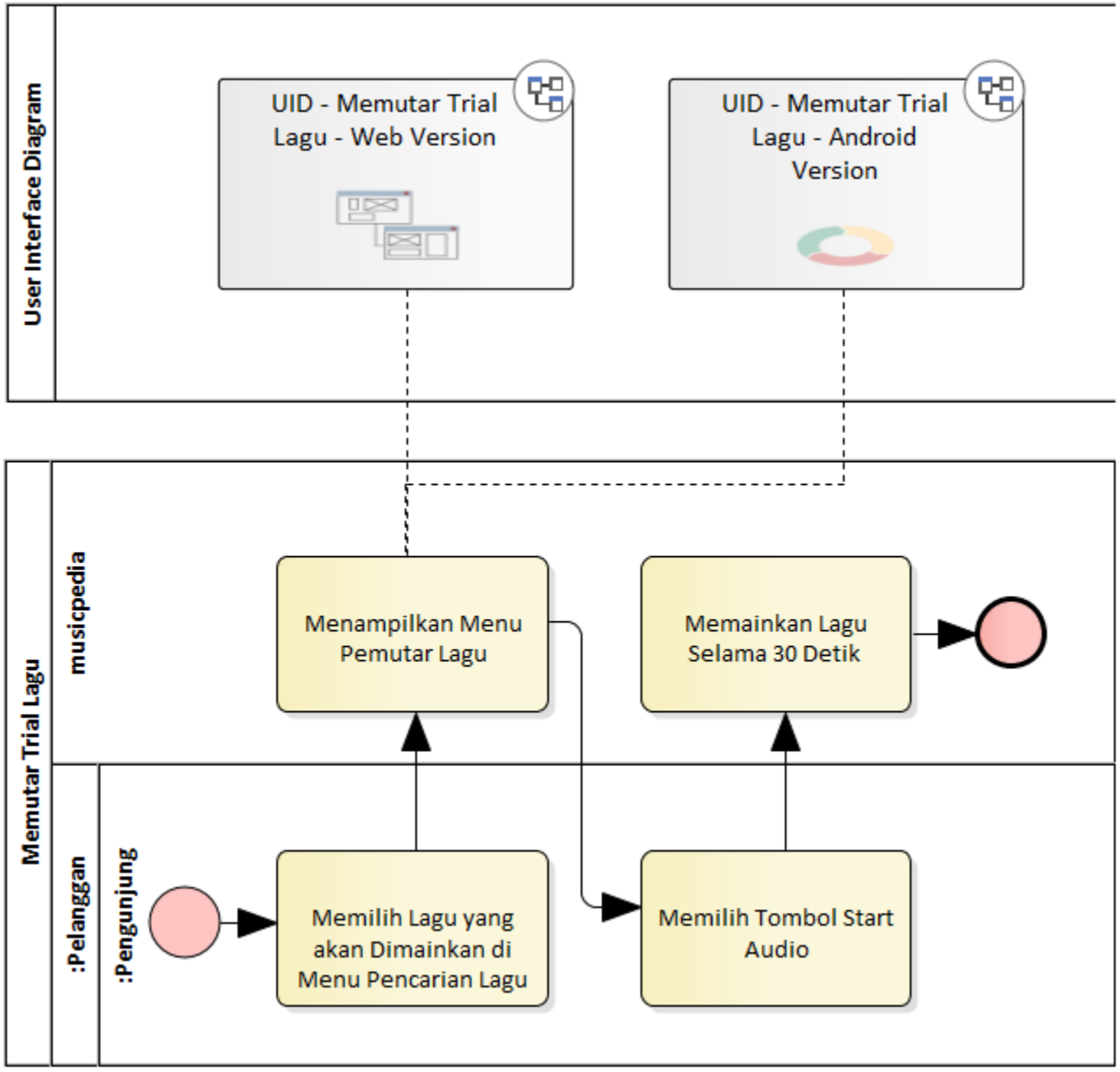
User Interface Design Melakukan Registrasi (versi Web dan versi Android)



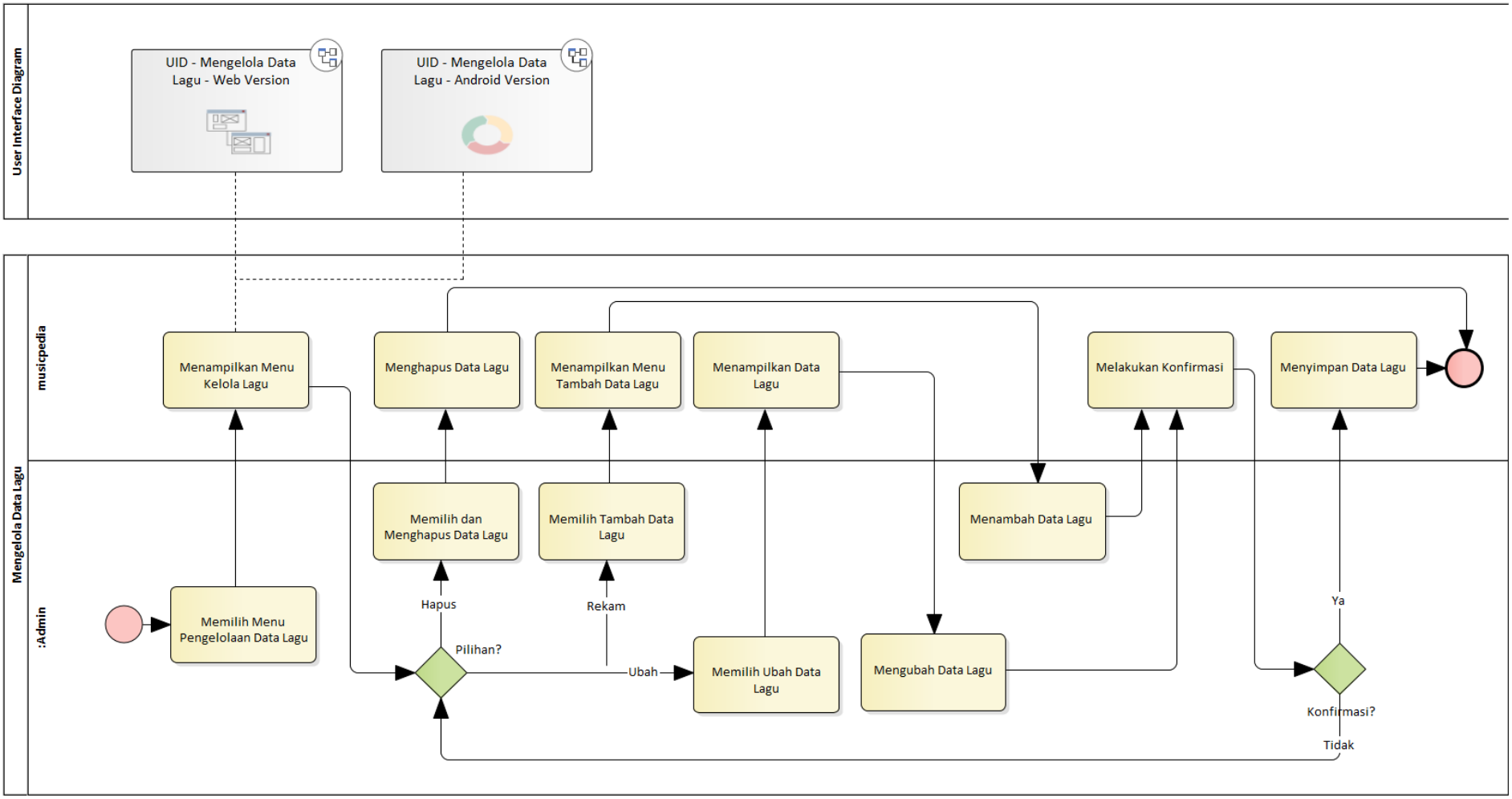
BPMN Melihat Daftar Lagu



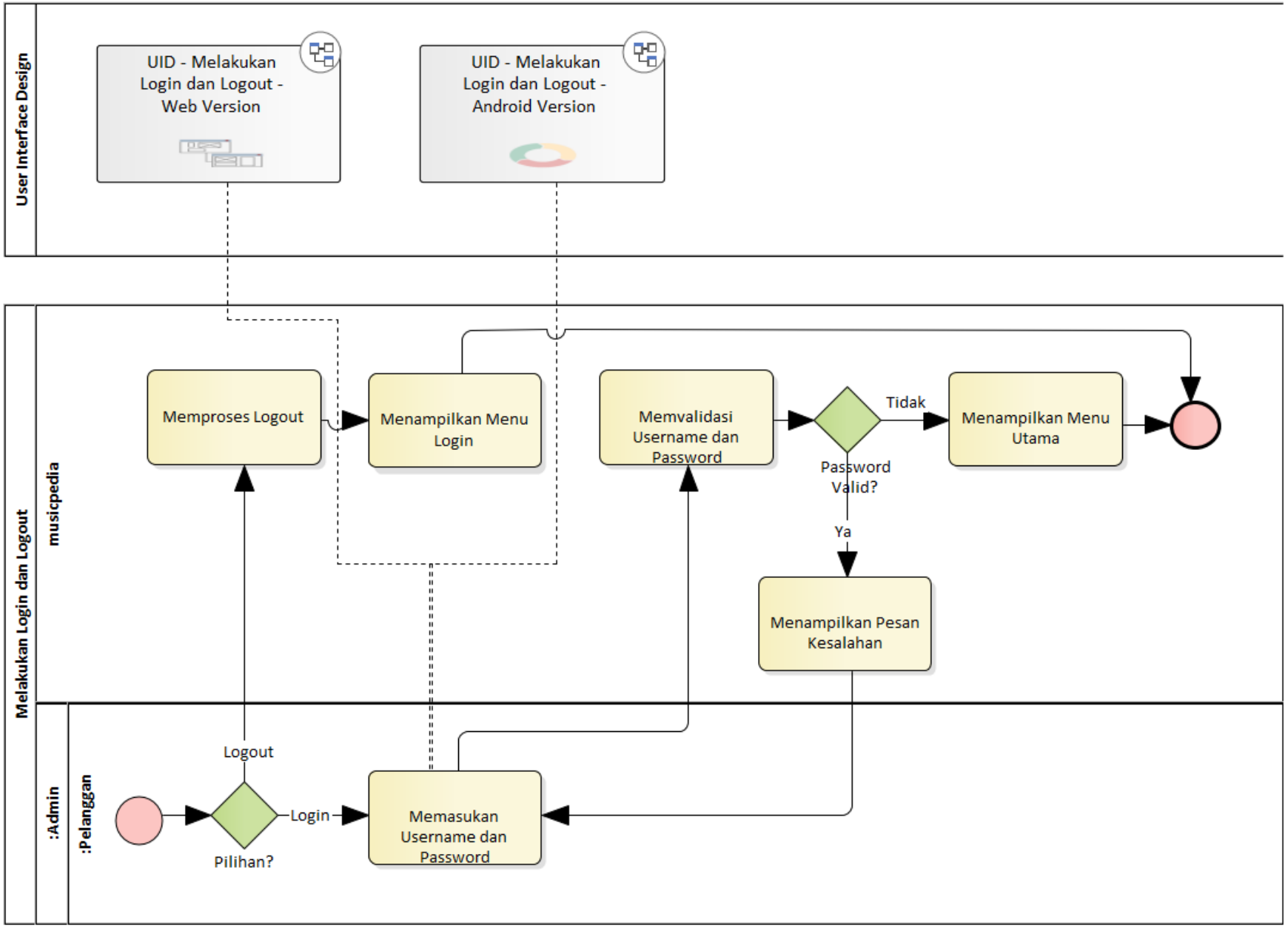
BPMN Memutar Trial Lagu



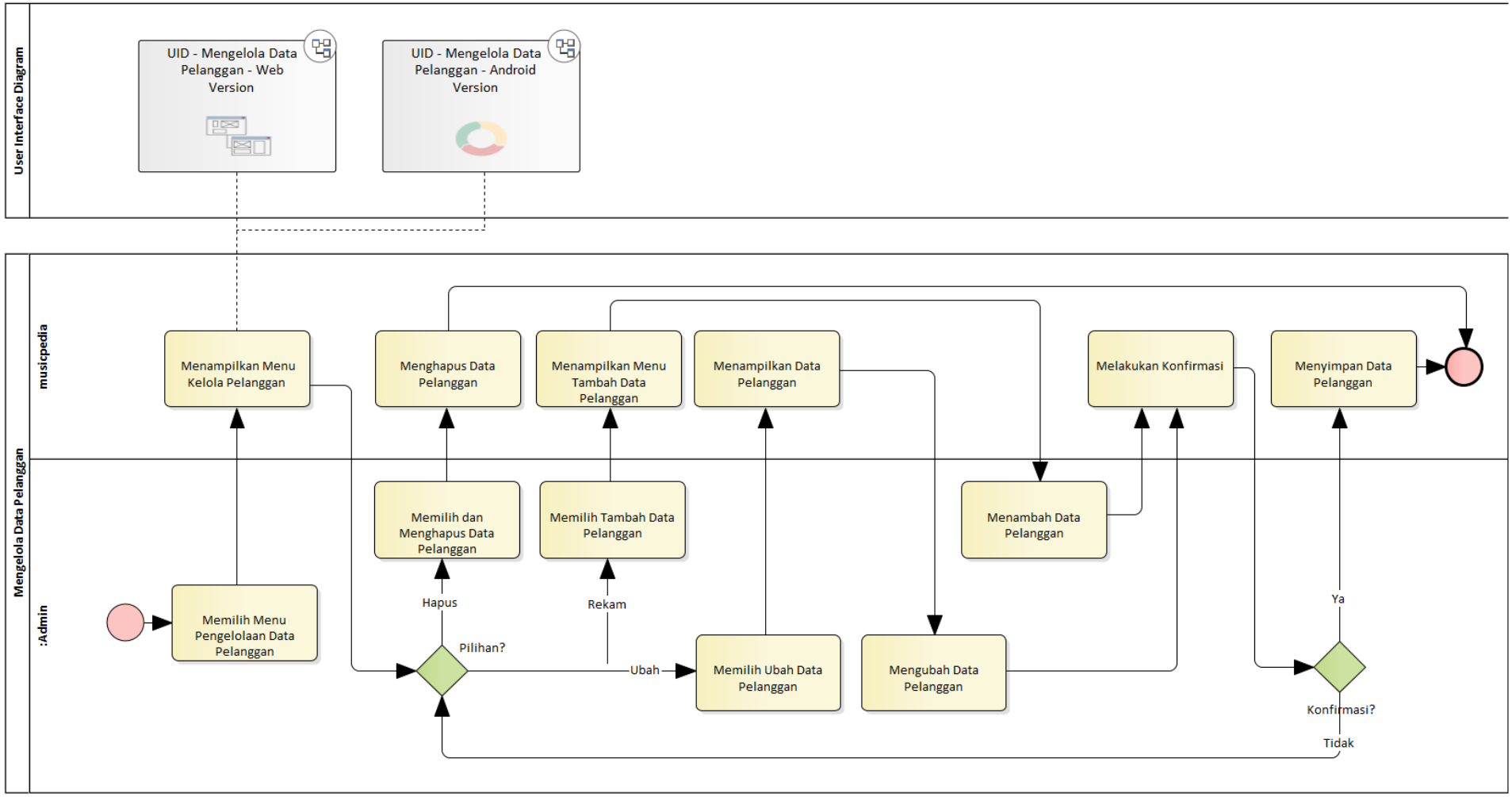
BPMN Mengelola Data Lagu



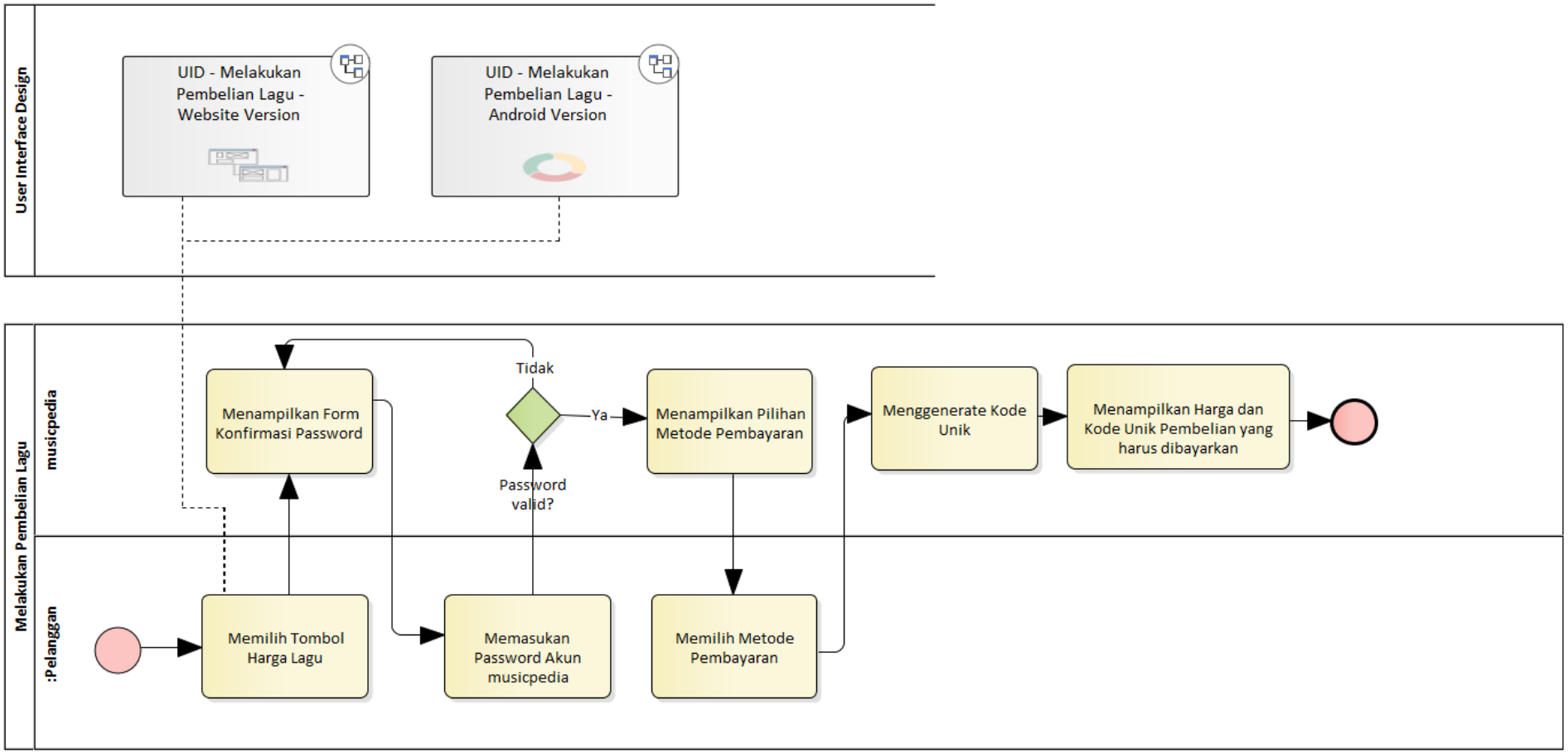
BPMN Melakukan Login dan Logout



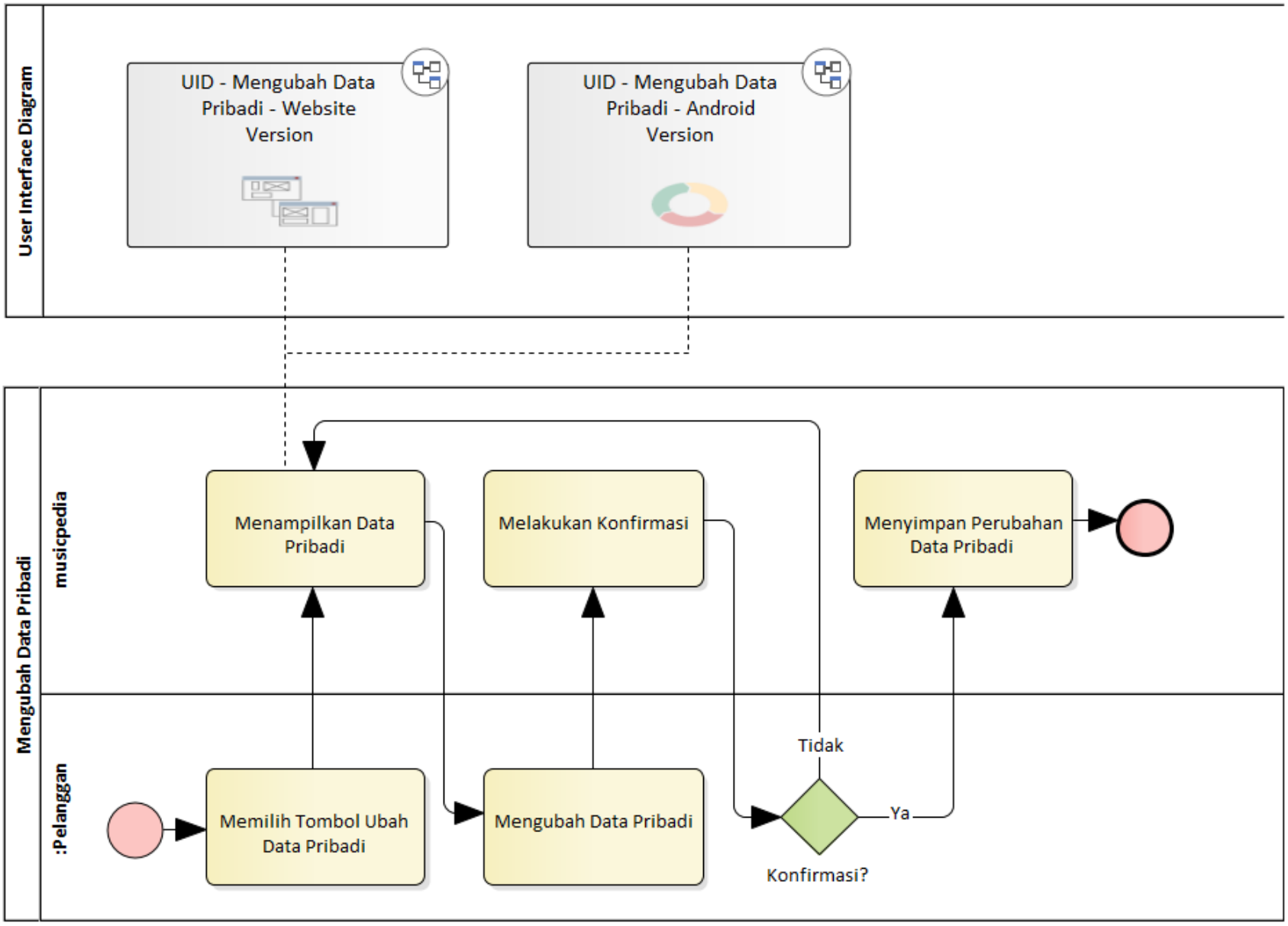
BPMN Mengelola Data Pelanggan



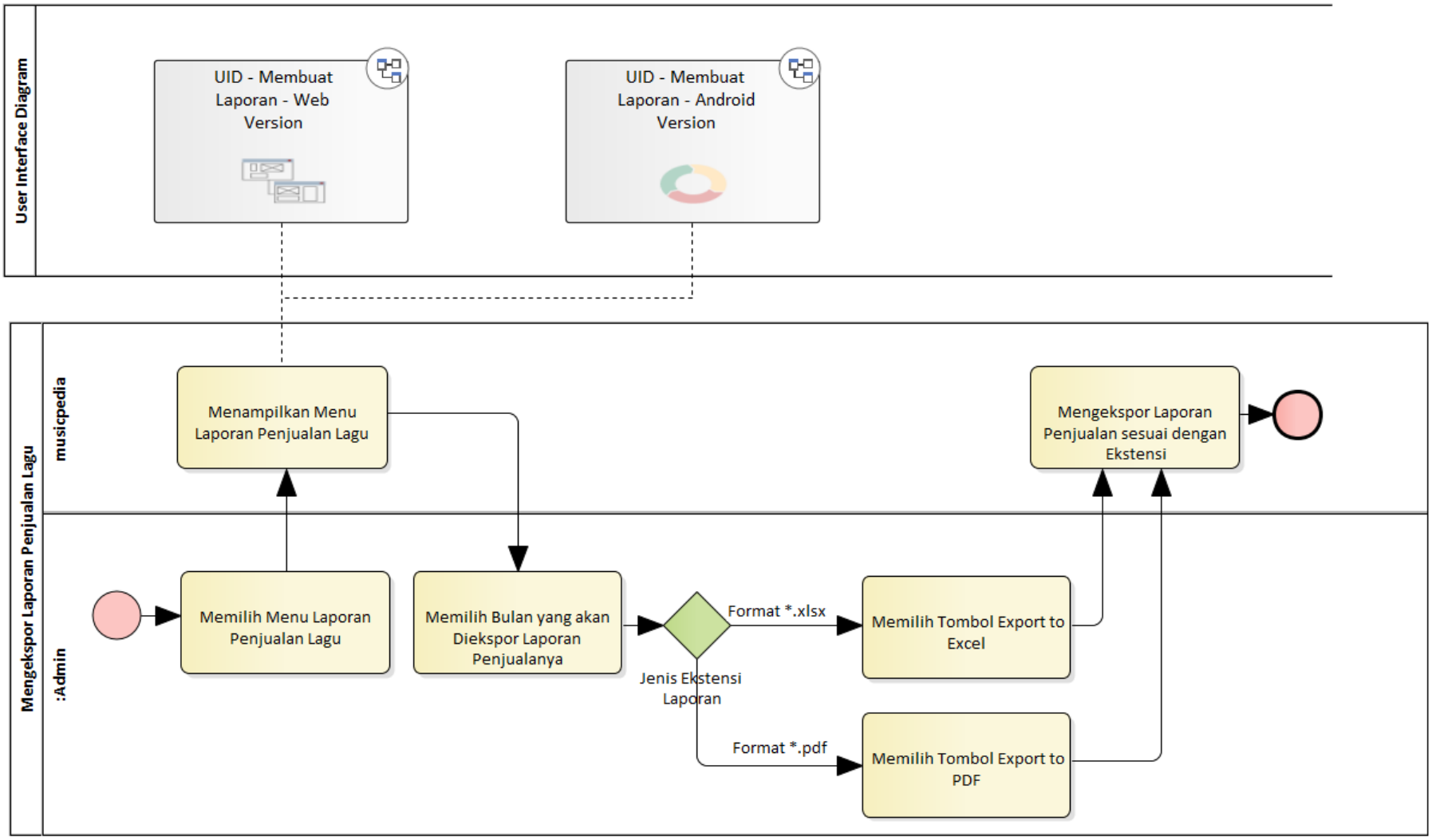
BPMN Melakukan Pembelian lagu



BPMN Mengubah Data Pribadi



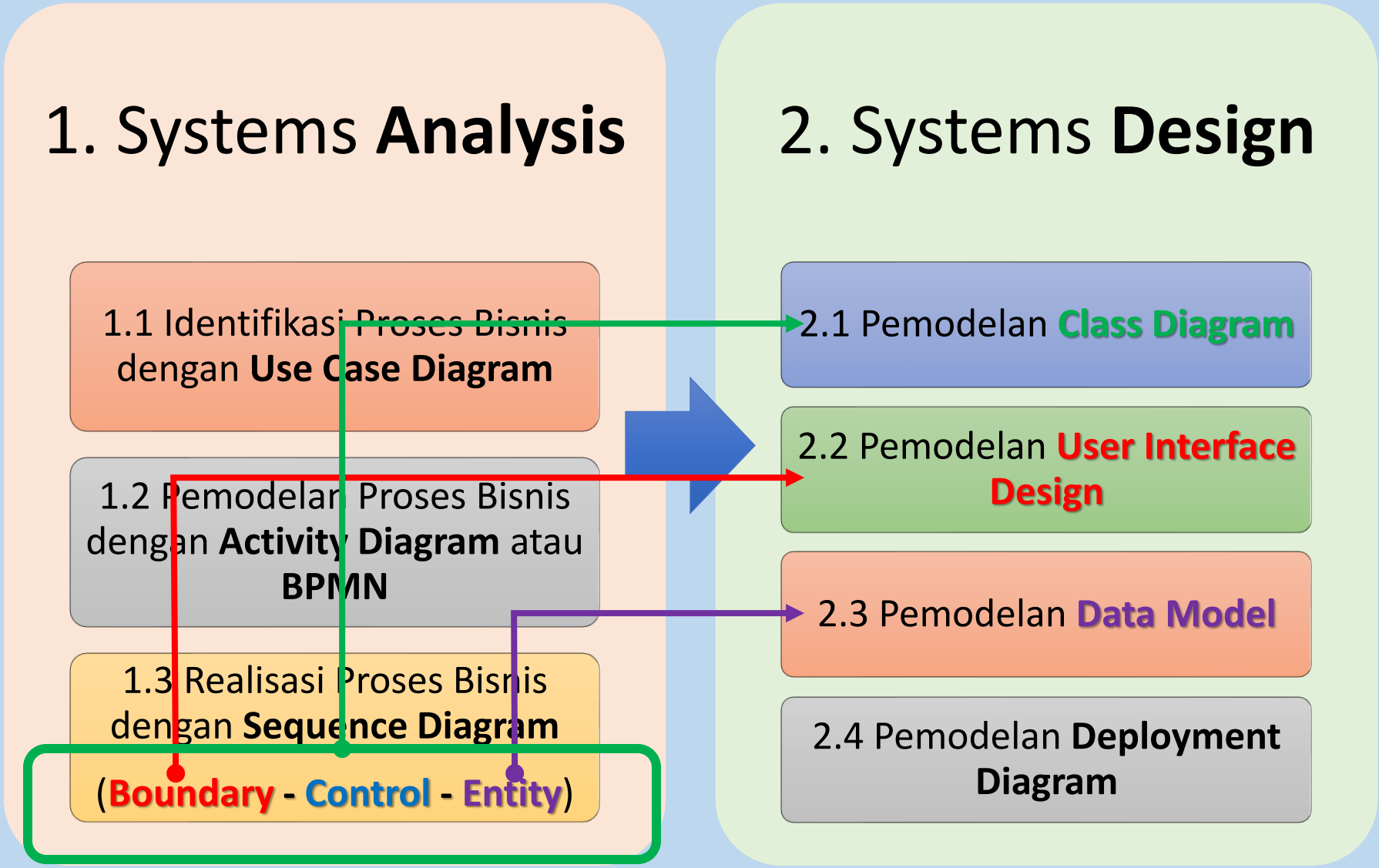
BPMN Mengekspor Laporan Penjualan Lagu



2.4 Realisasi Proses Bisnis dengan Sequence Diagram

UML based Software Analysis and Design

(Wahono, 2009)

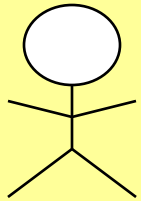
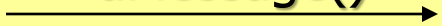


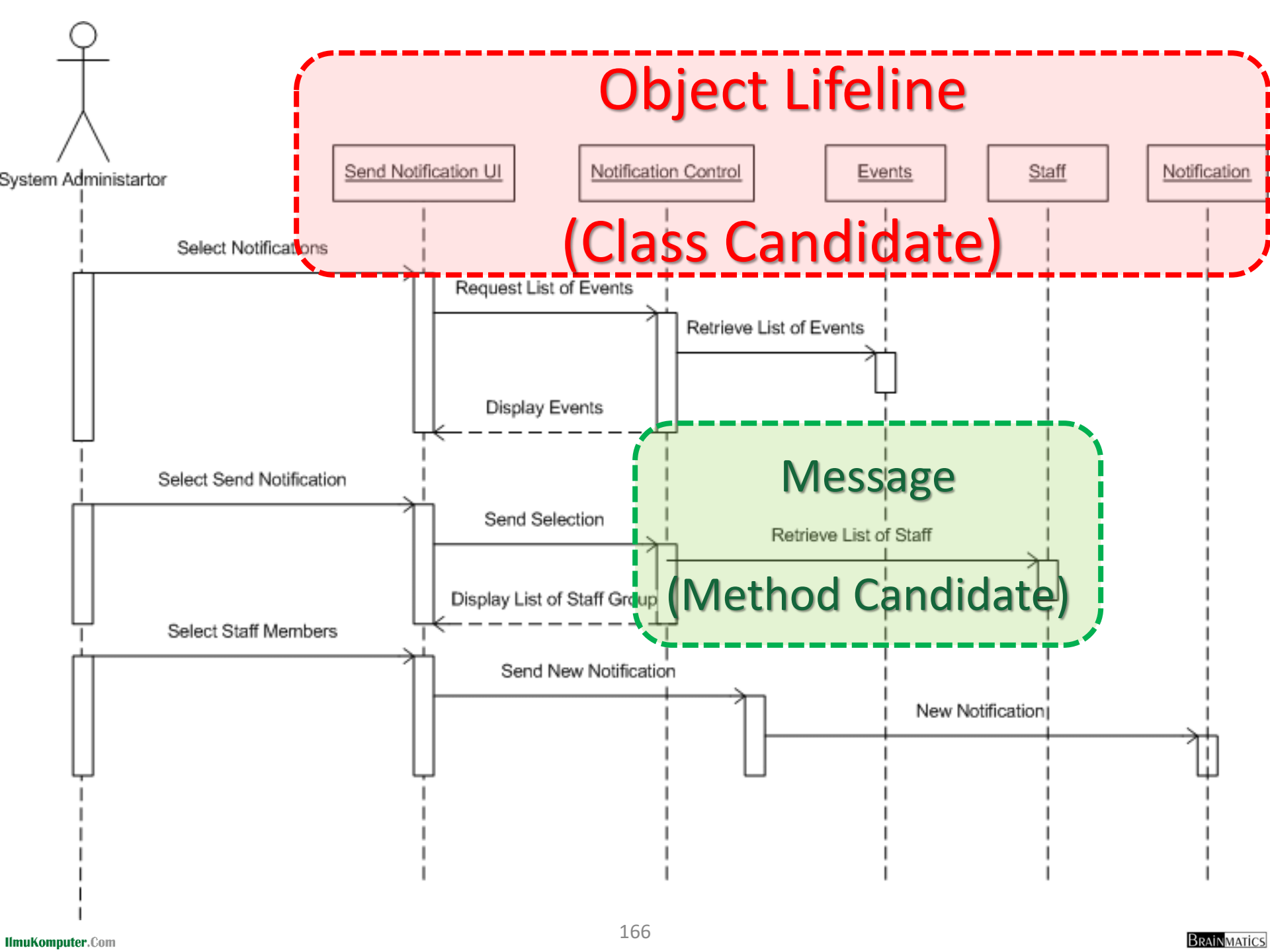
Sequence Diagram

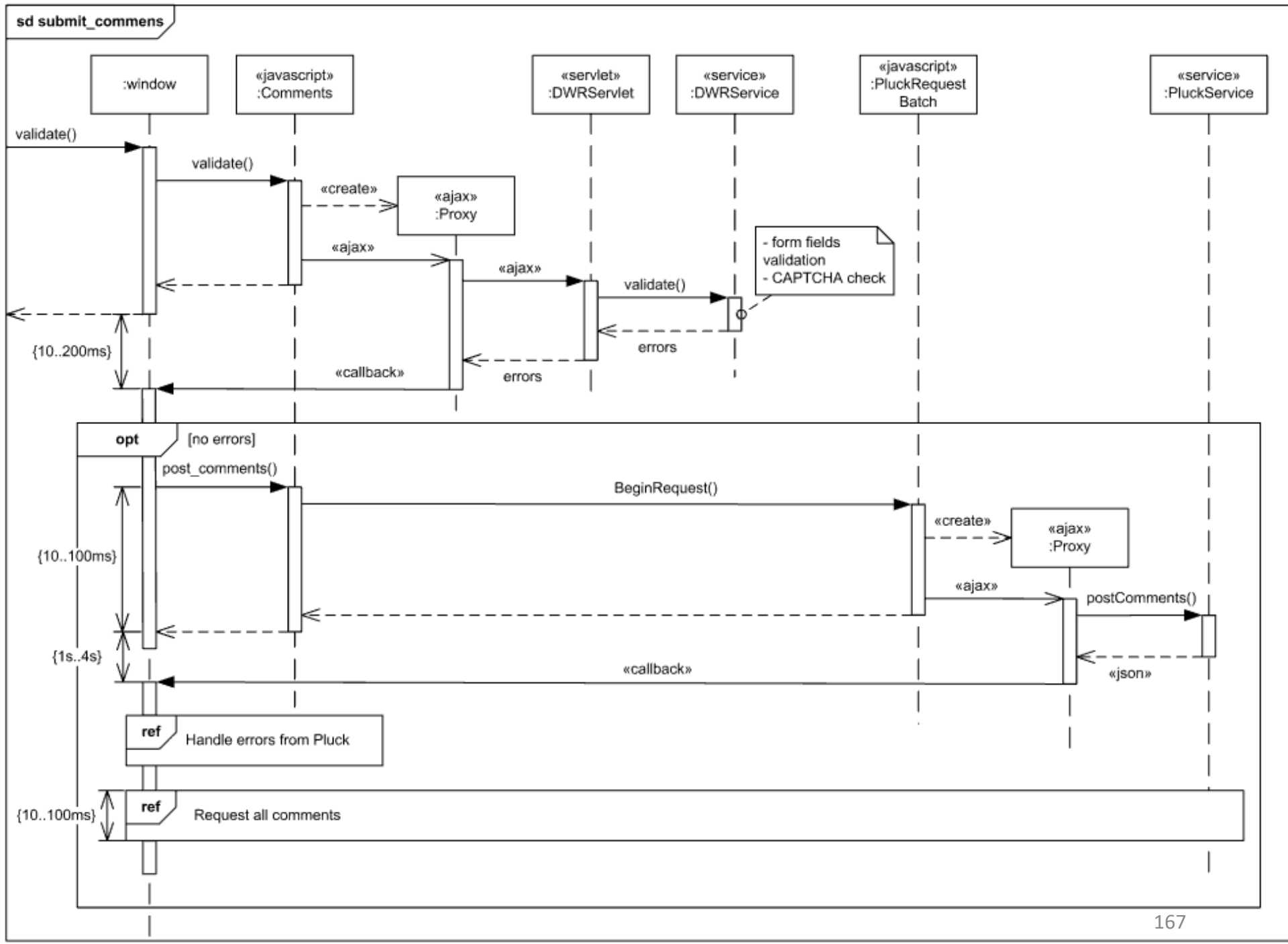
- Sequence diagram menggambarkan interaksi antar *object* (*class*) dalam sofware pada suatu sekuensial waktu
  - Interaksi object (class) berdasarkan alur proses bekerjanya software, dimana interaksi tersebut menggambarkan pesan yang dikirimkan secara sekuensial antara object (class)
  - Garis vertikal (lifeline) menunjukkan object (class), garis horizontal menunjukkan pesan yang mengalir antara object (class) tersebut

- Sequence diagram adalah alat komunikasi System Analyst dengan Programmer, menggambarkan alur proses bekerjanya software sekaligus dengan komposisi software akan seperti apa

Sequence Diagram Syntax

AN ACTOR	
AN OBJECT	anObject:aClass
A LIFELINE	
A FOCUS OF CONTROL	
A MESSAGE	aMessage() 
OBJECT DESTRUCTION	X

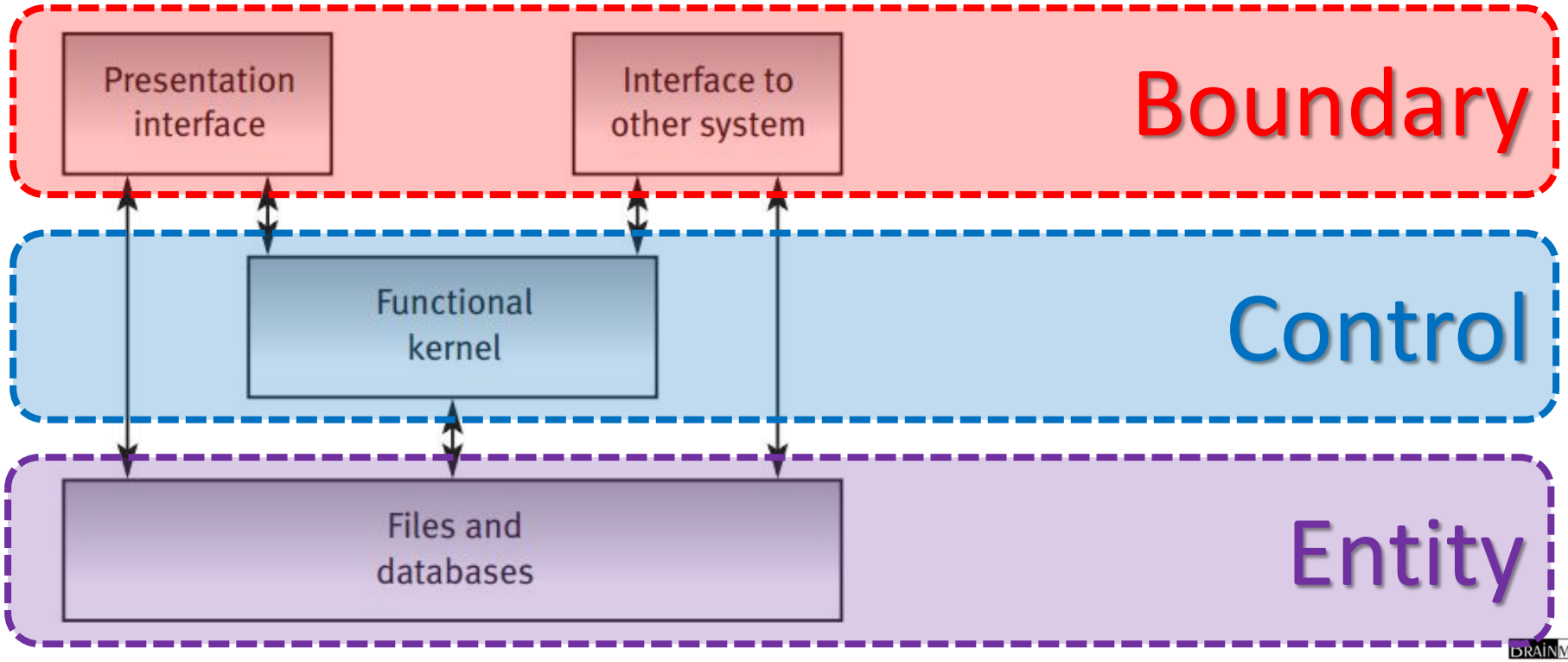




Denert's Law (1991)

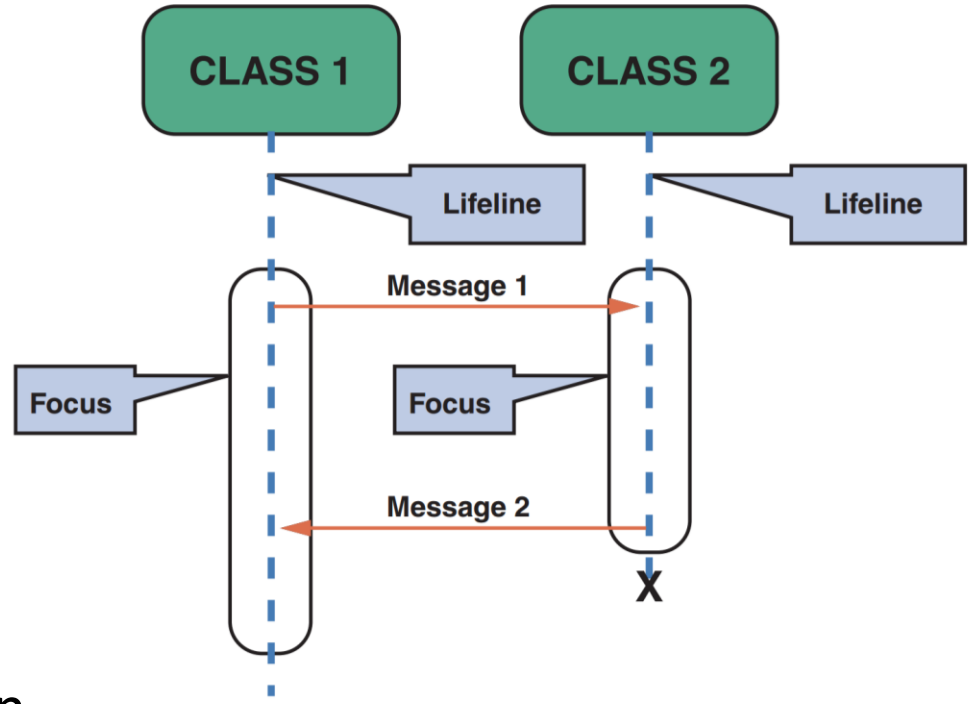
Separation of concerns leads to standard architectures

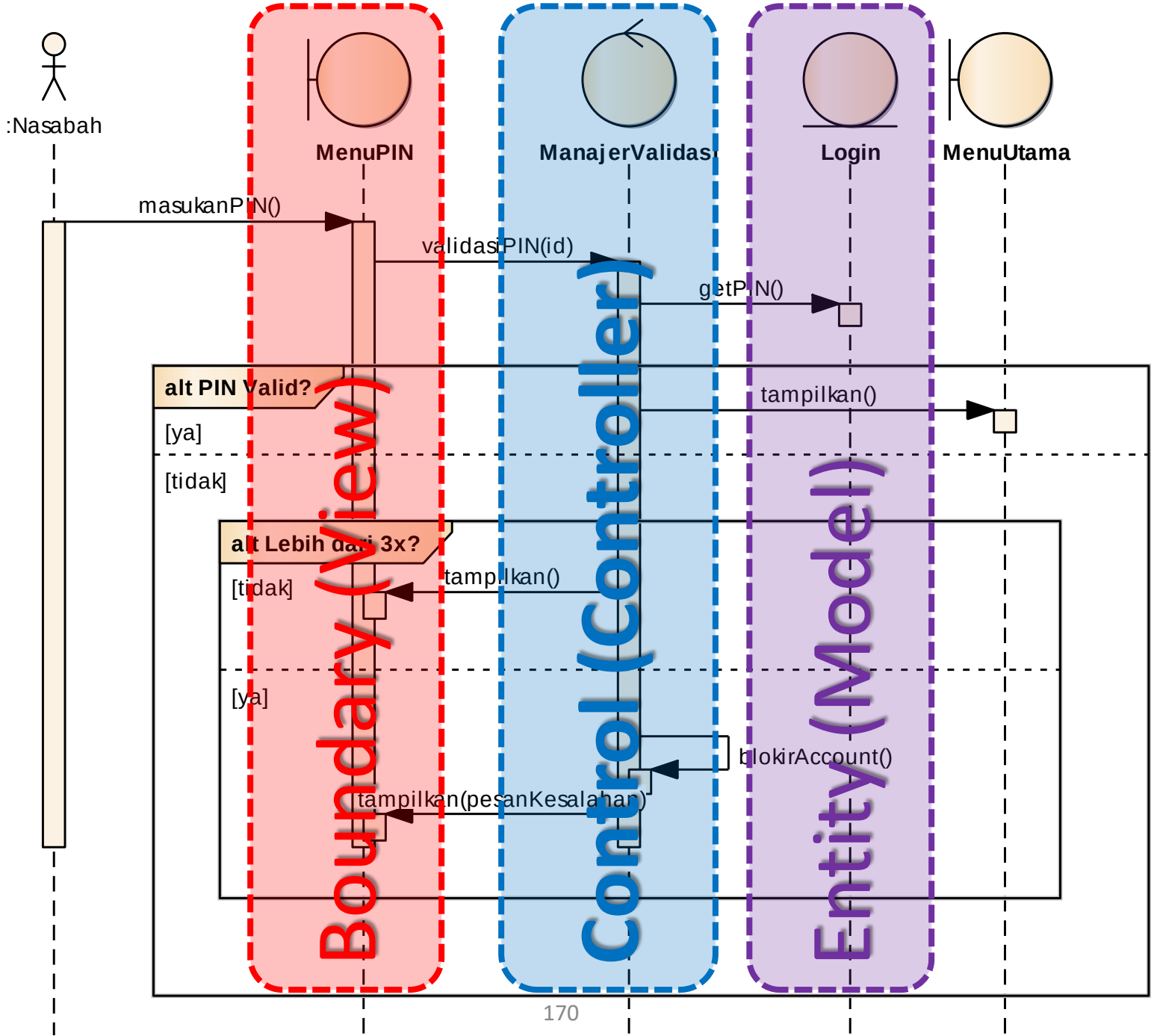
(Endres, 2003) *[L9]*

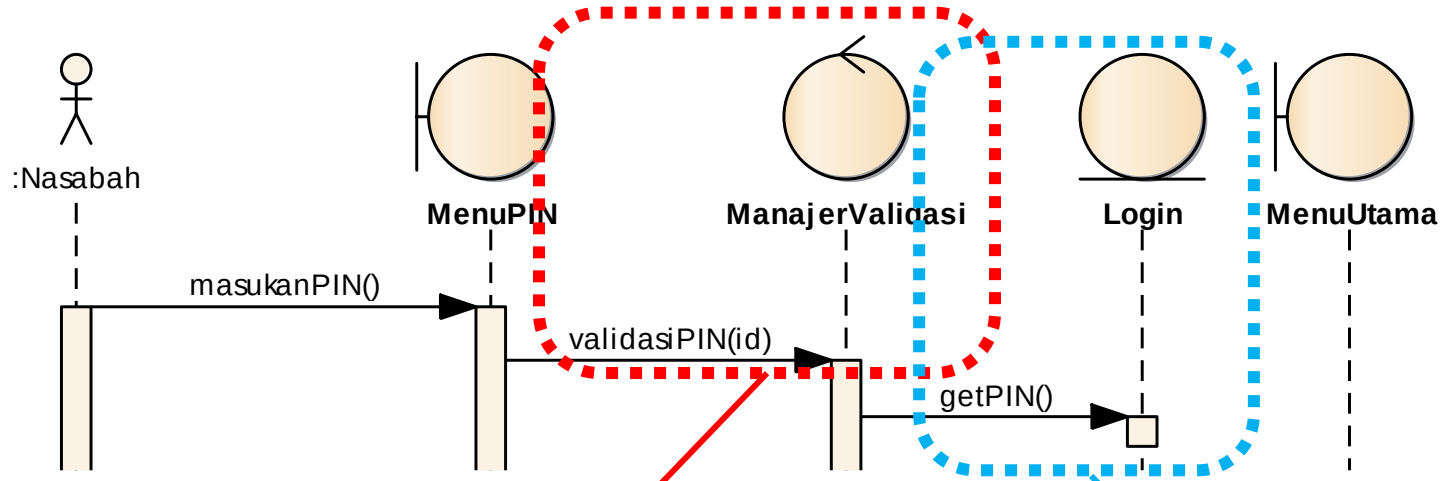


Sequence Diagram berbasis Arsitektur Boundary – Control – Entity

1. Boundary Class:
   - Class yang berinteraksi dengan aktor langsung (user interface)
   - Form, input, UI, dsb
2. Control Class:
   - Class yang berhubungan dengan pemrosesan, penghitungan, kalkulasi, komputasi, query, dst
3. Entity Class:
   - Class yang berhubungan dengan data, penyimpanan data/file








```
public class ManajerValidasi {

        private Login m_Login;

        public int validasiKartu(){

        }

        public int validasiPIN(){
            int pin = m_Login.getPIN();
            if(pin.equals(pinuser)){
                        MenuUtama.show()};
        }

        public void blokirKartu(){

        }
}
```

```
public class Login {

        public int getPIN(){

        }

}
```

Sequence Diagram

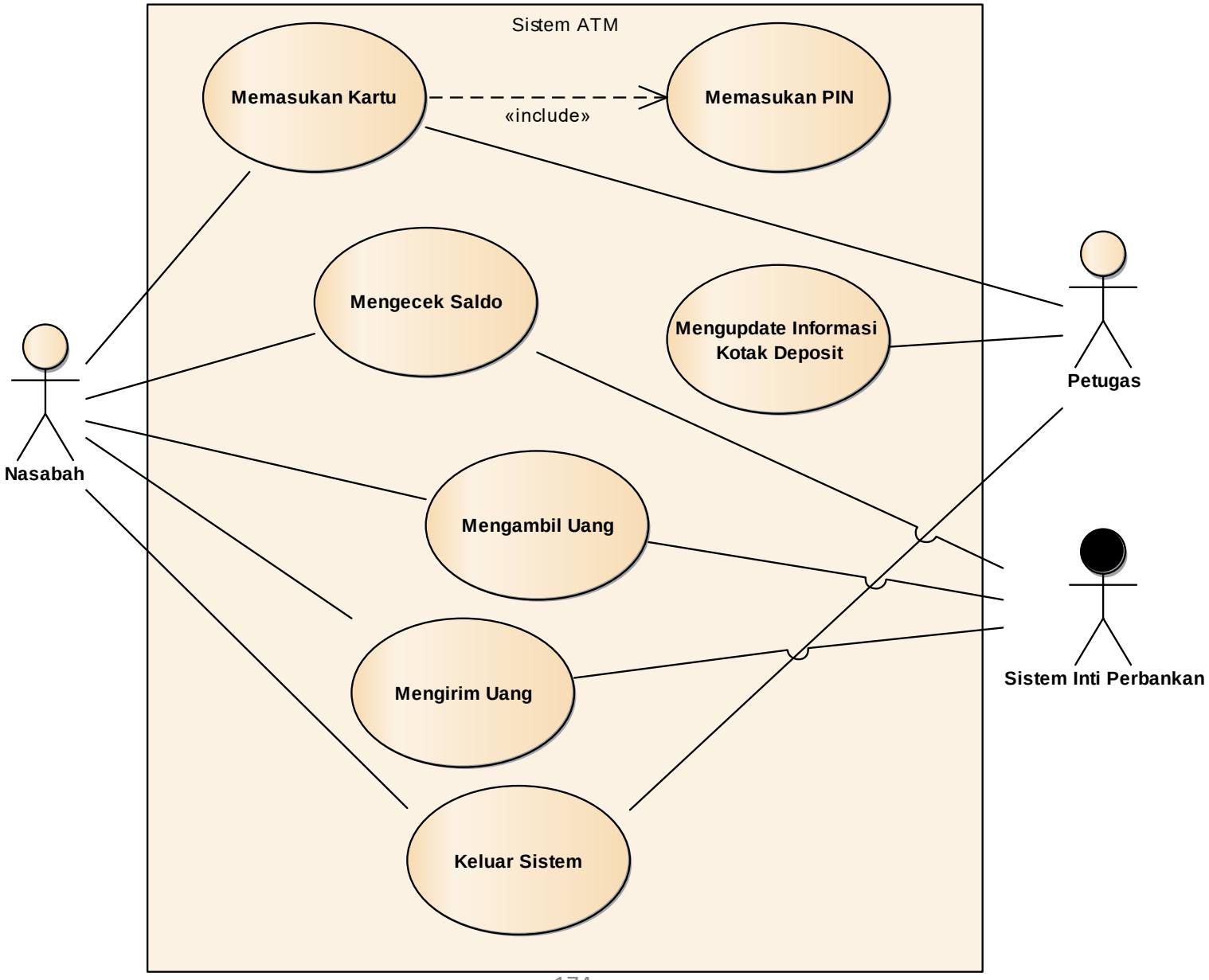
- Sequence Diagram dibuat untuk setiap Use Case yang dibuat

- Dimulai dari menarik Actor yang ada di Use Case Diagram, dilanjutkan dengan membuat sequence detail dari alur proses berjalannya Use Case dengan message yang mengalir didalamnya

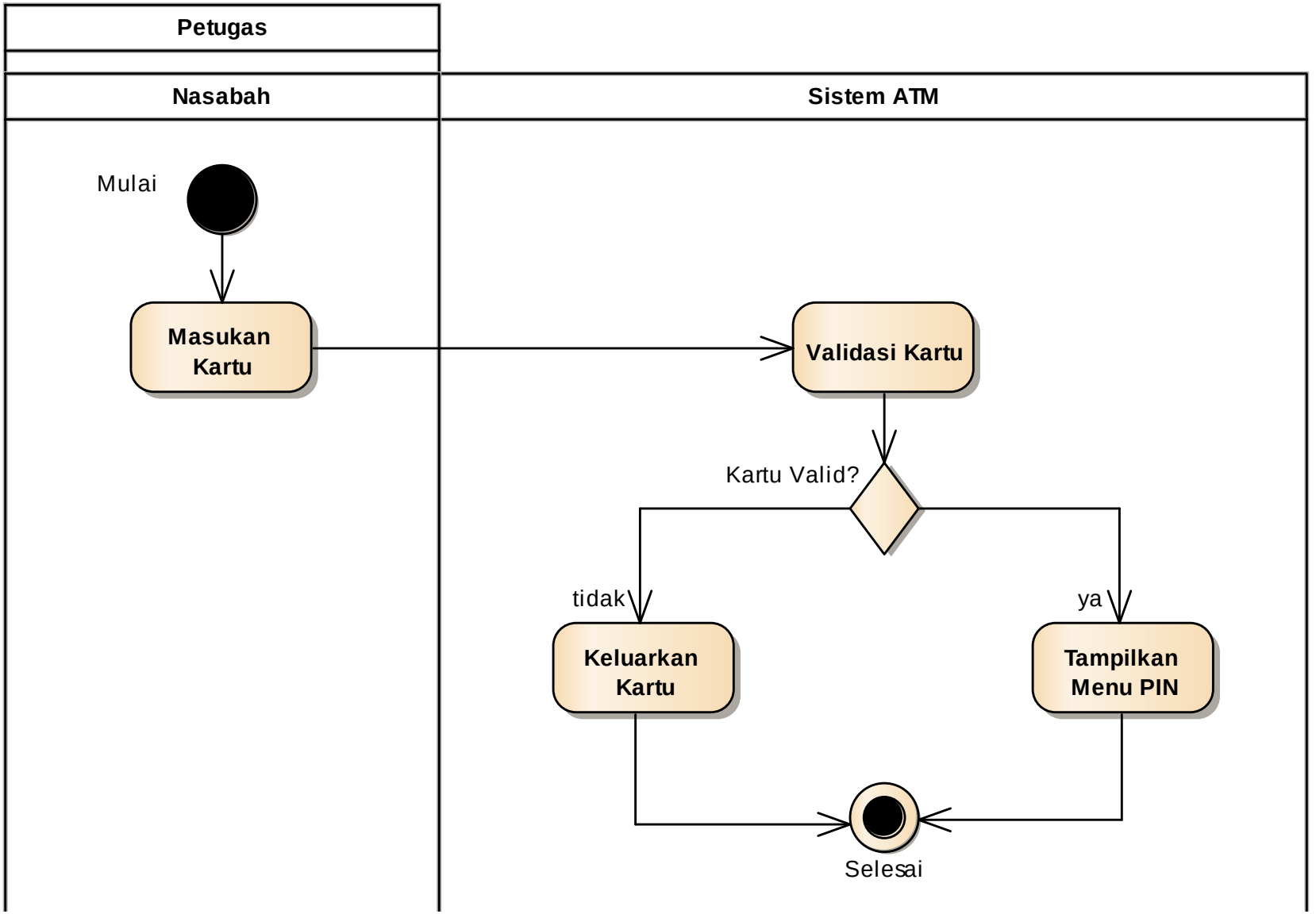
- Catatan: Objek dari Lifeline di Sequence Diagram akan menjadi kandidat Class, karena itulah harus mengikuti arsitektur Boundary – Control – Class

Studi Kasus: Sequence Diagram Sistem ATM

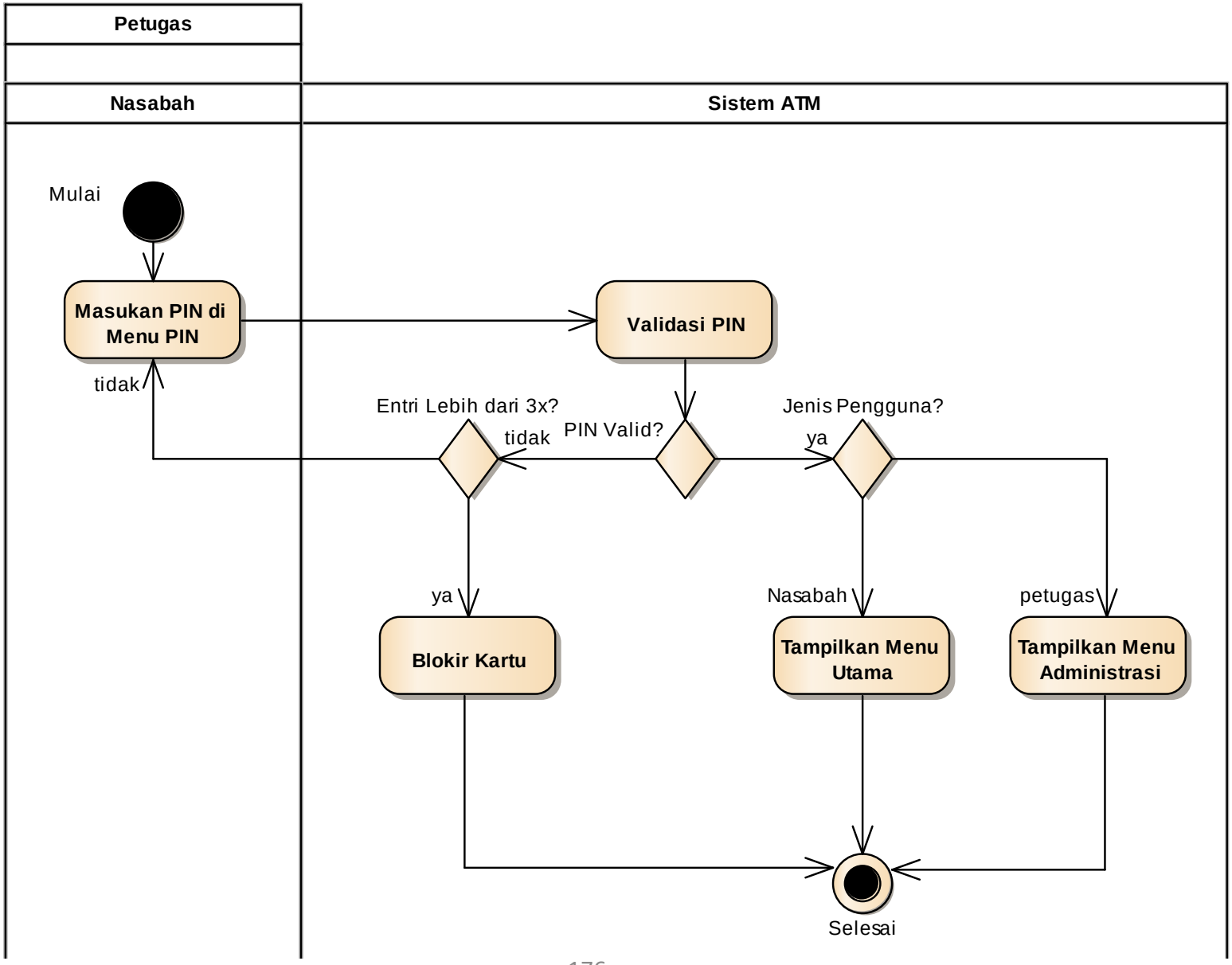
Use Case Diagram Sistem ATM



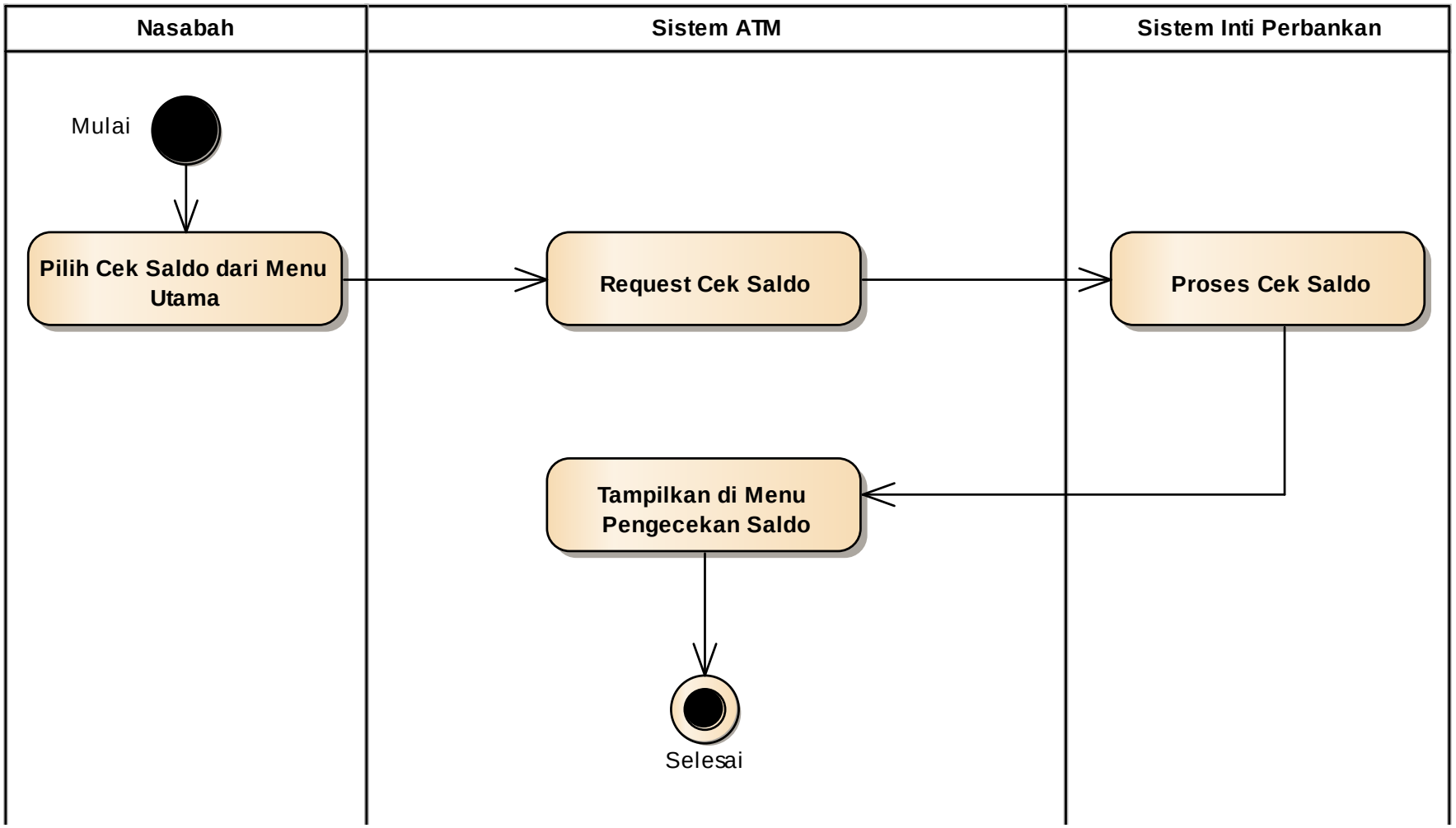
Activity Diagram: Memasukkan Kartu



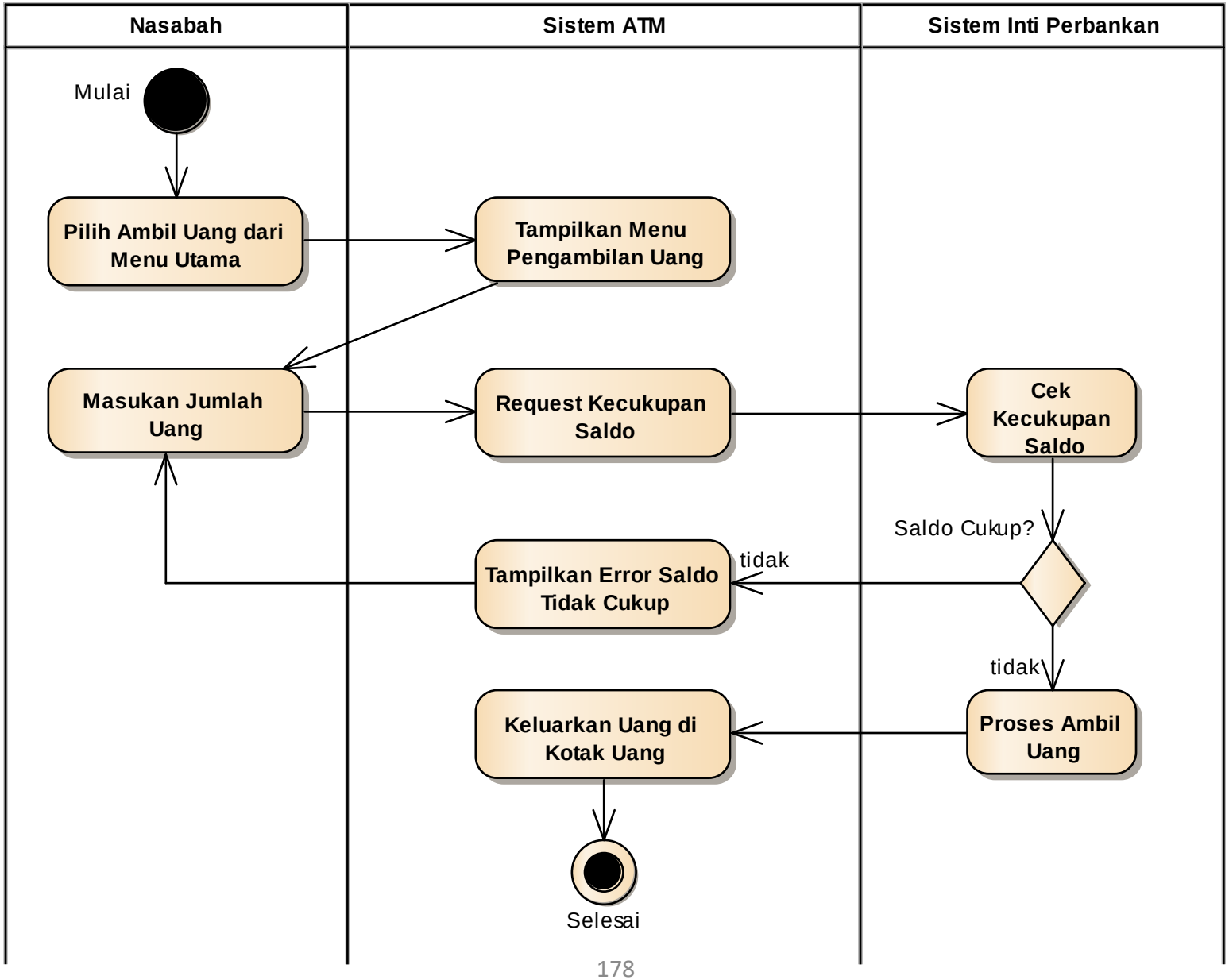
Activity Diagram: Memasukkan PIN



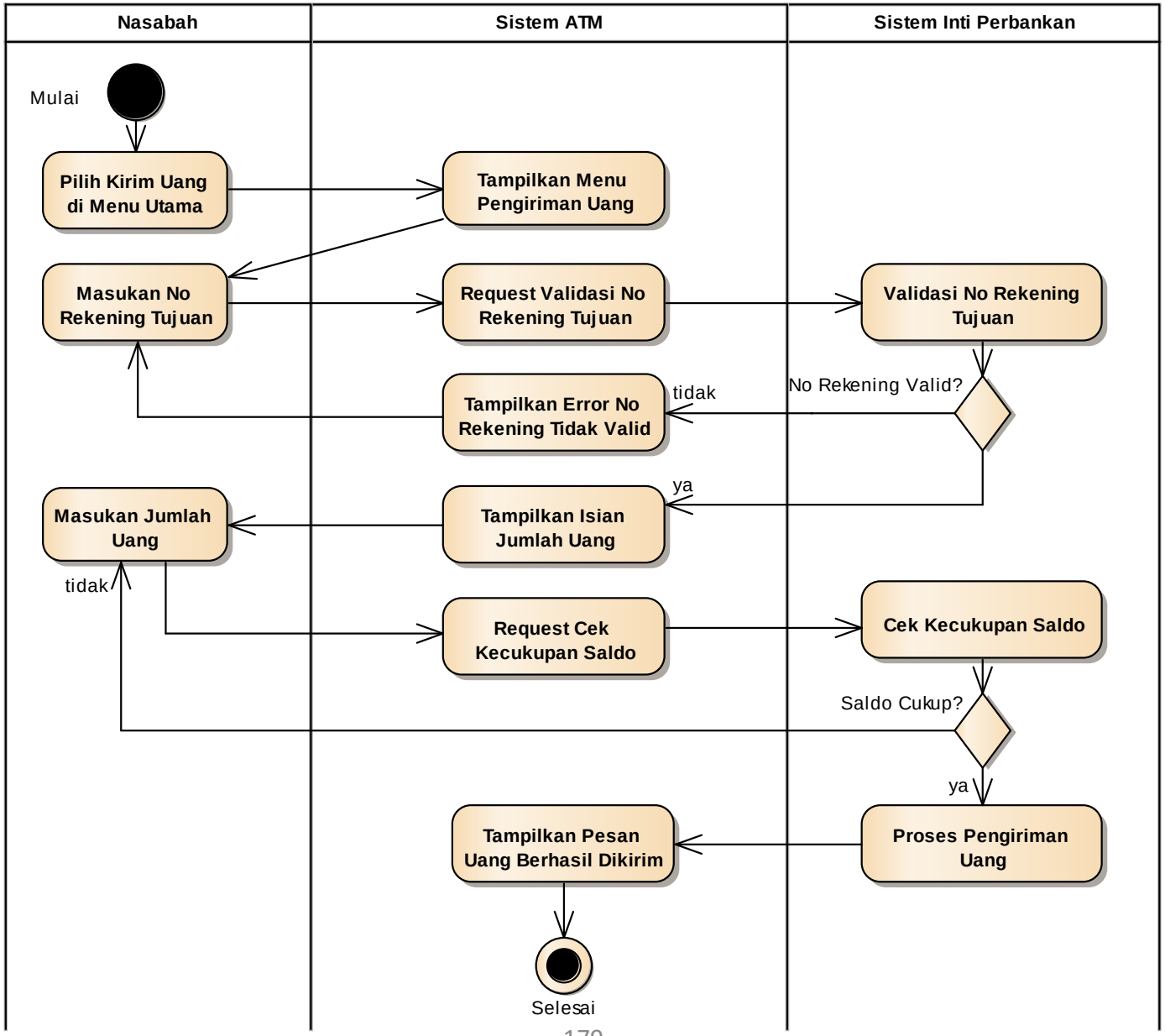
Activity Diagram: Mengecek Saldo



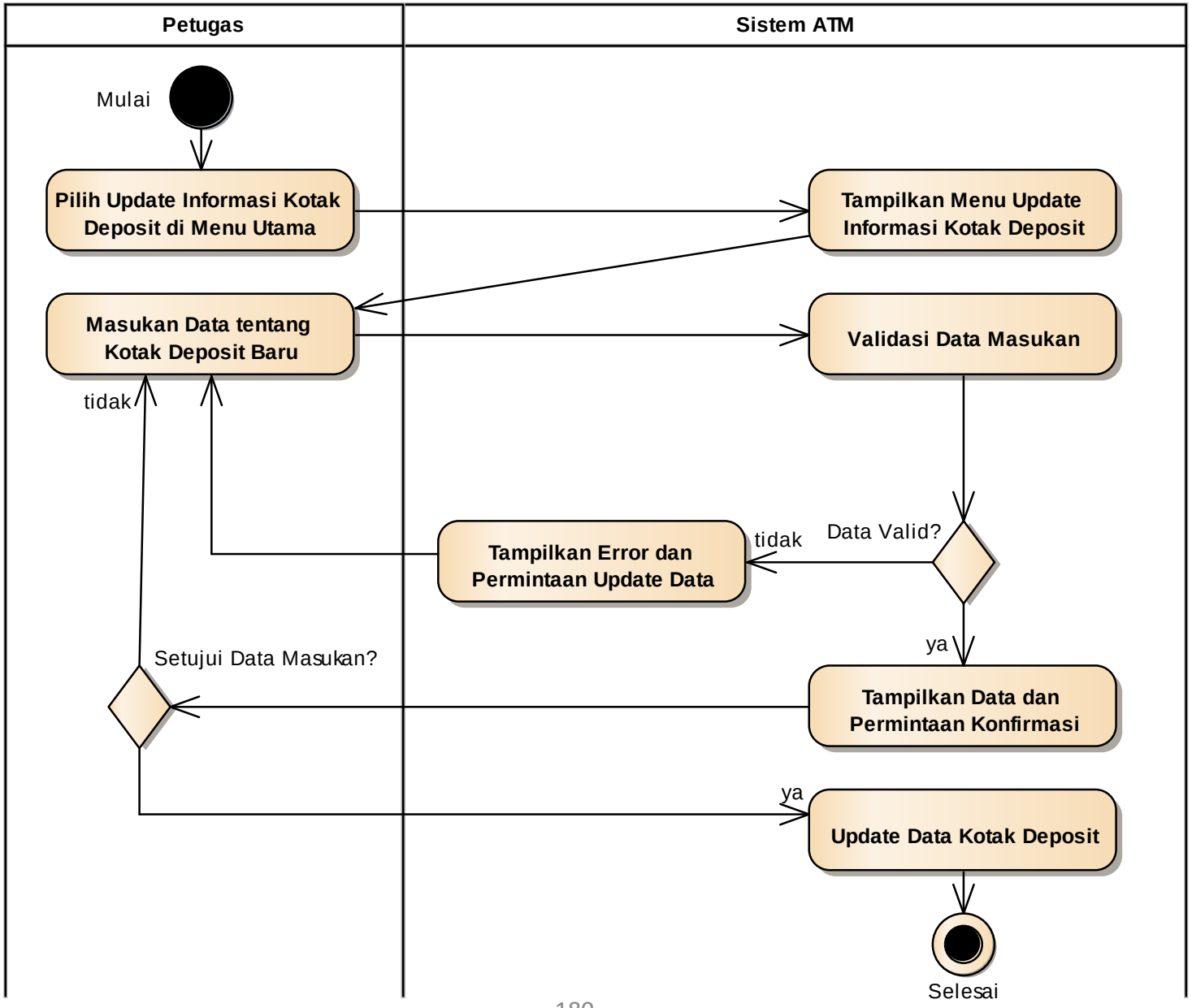
Activity Diagram: Mengambil Uang



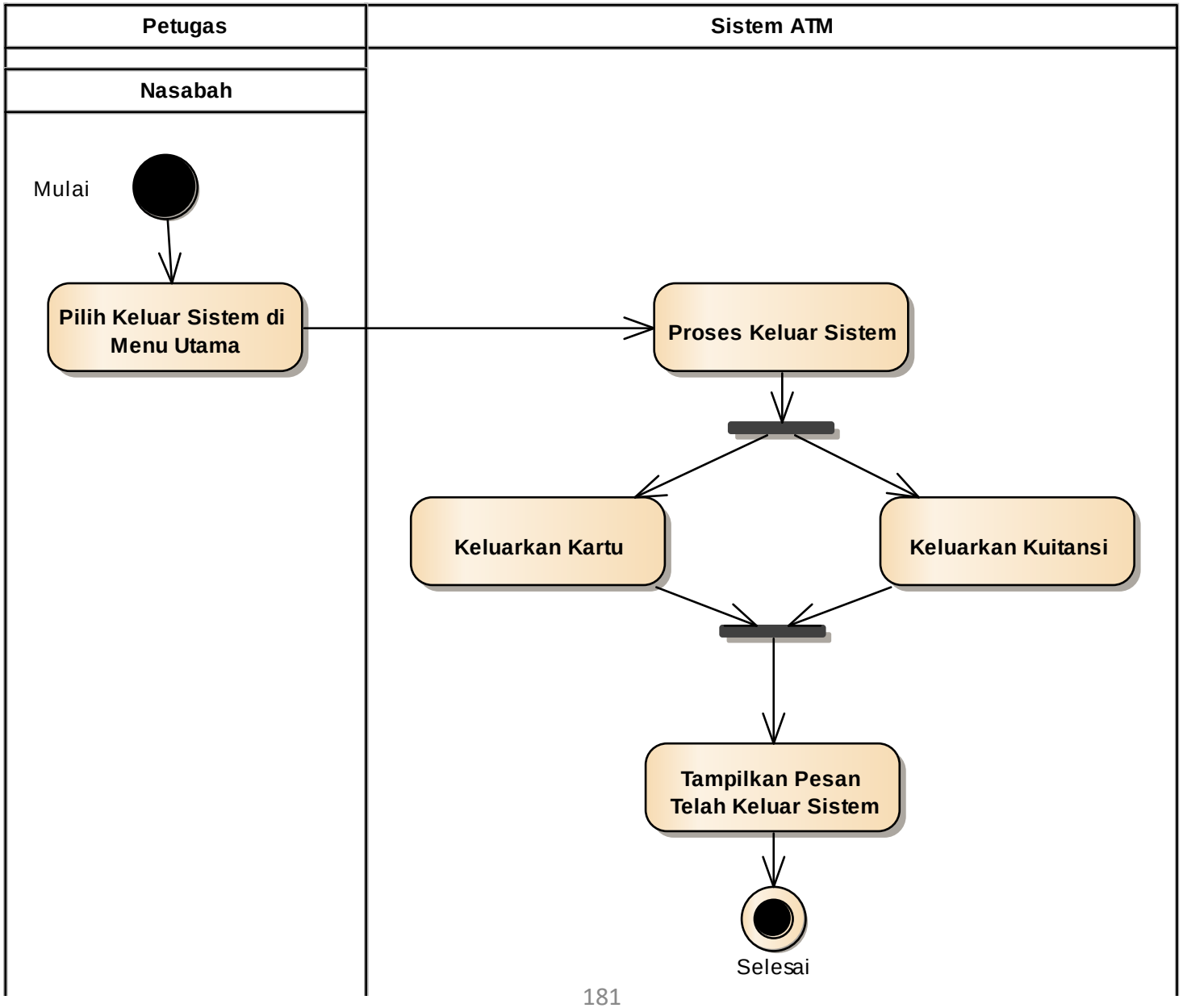
Activity Diagram: Mengirim Uang



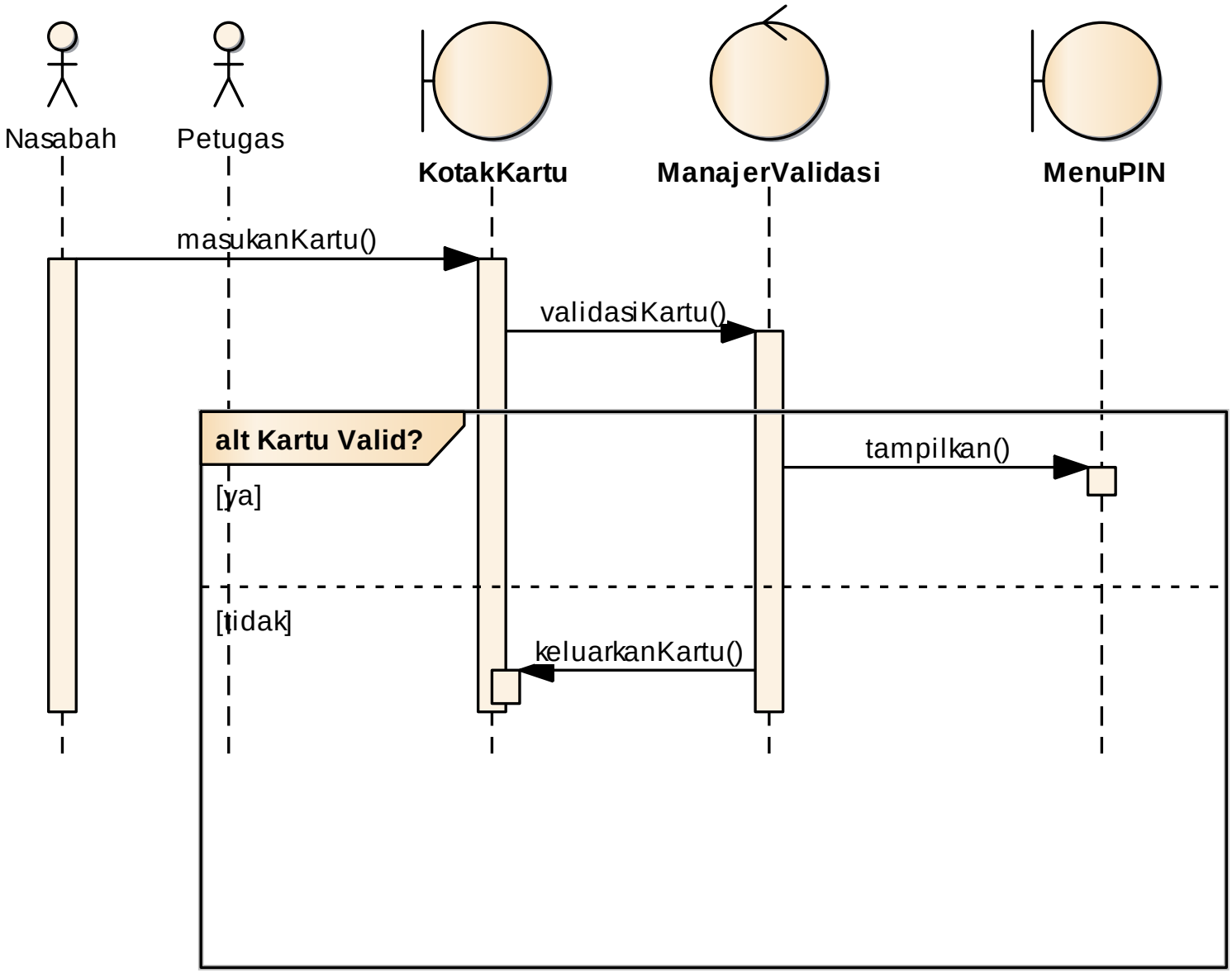
Activity Diagram: Mengupdate Informasi Kotak Deposit



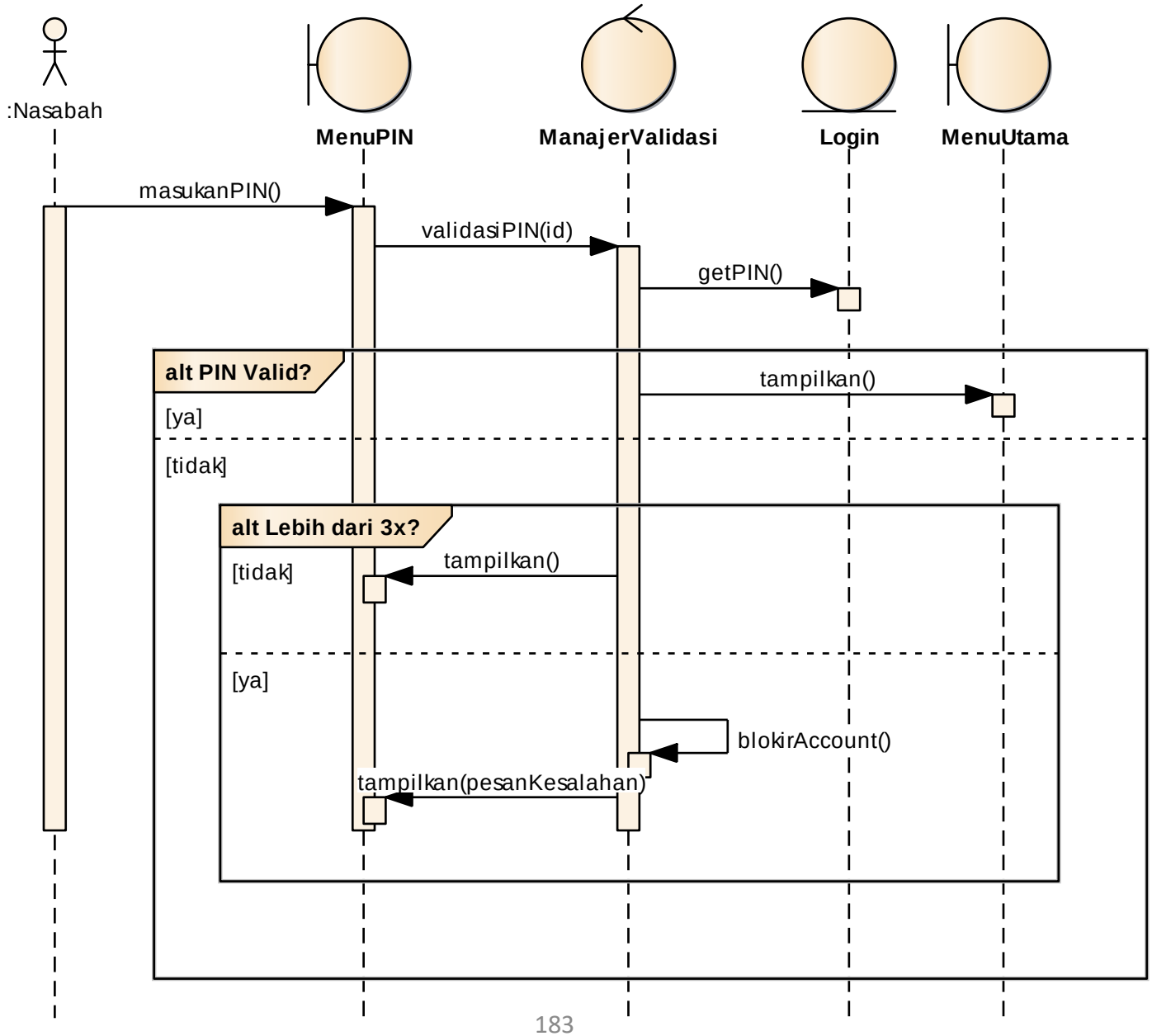
Activity Diagram: Keluar Sistem



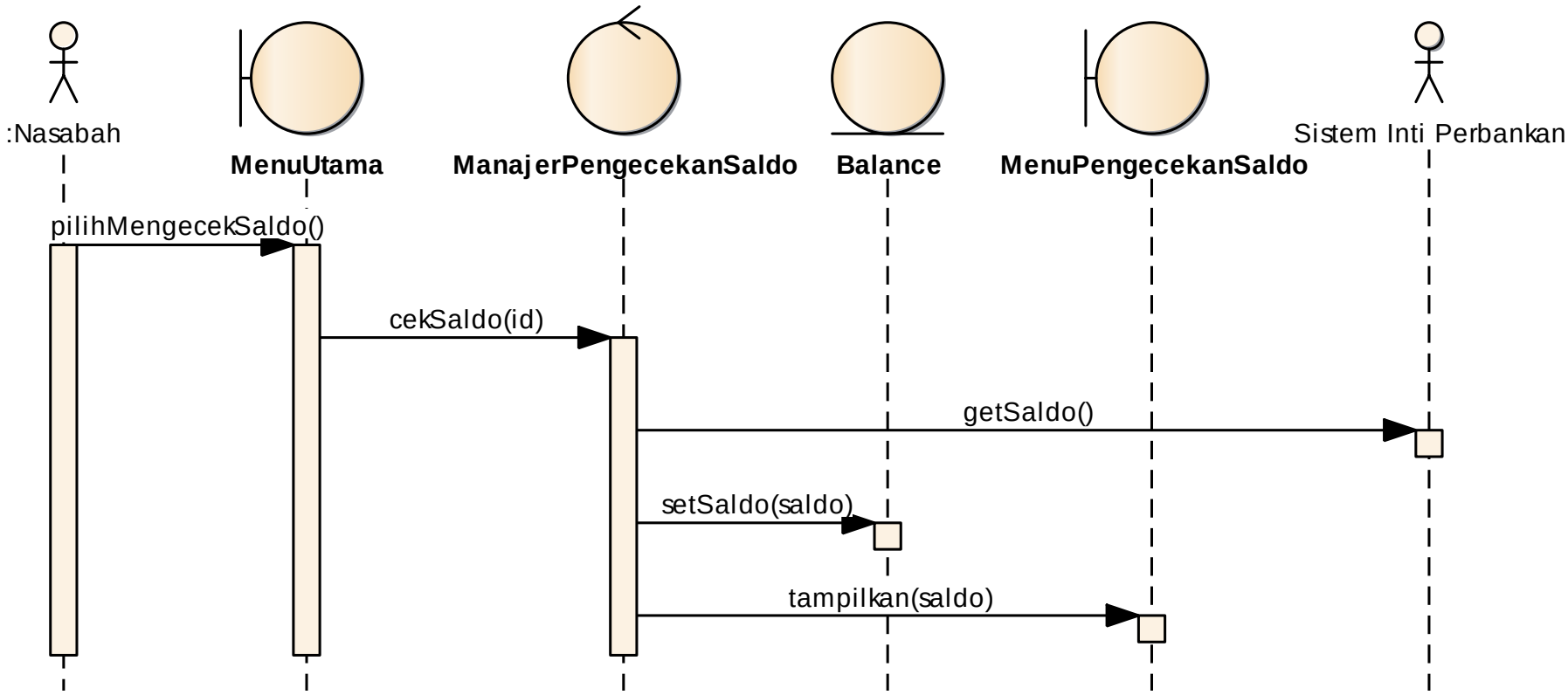
Sequence Diagram: Memasukkan Kartu



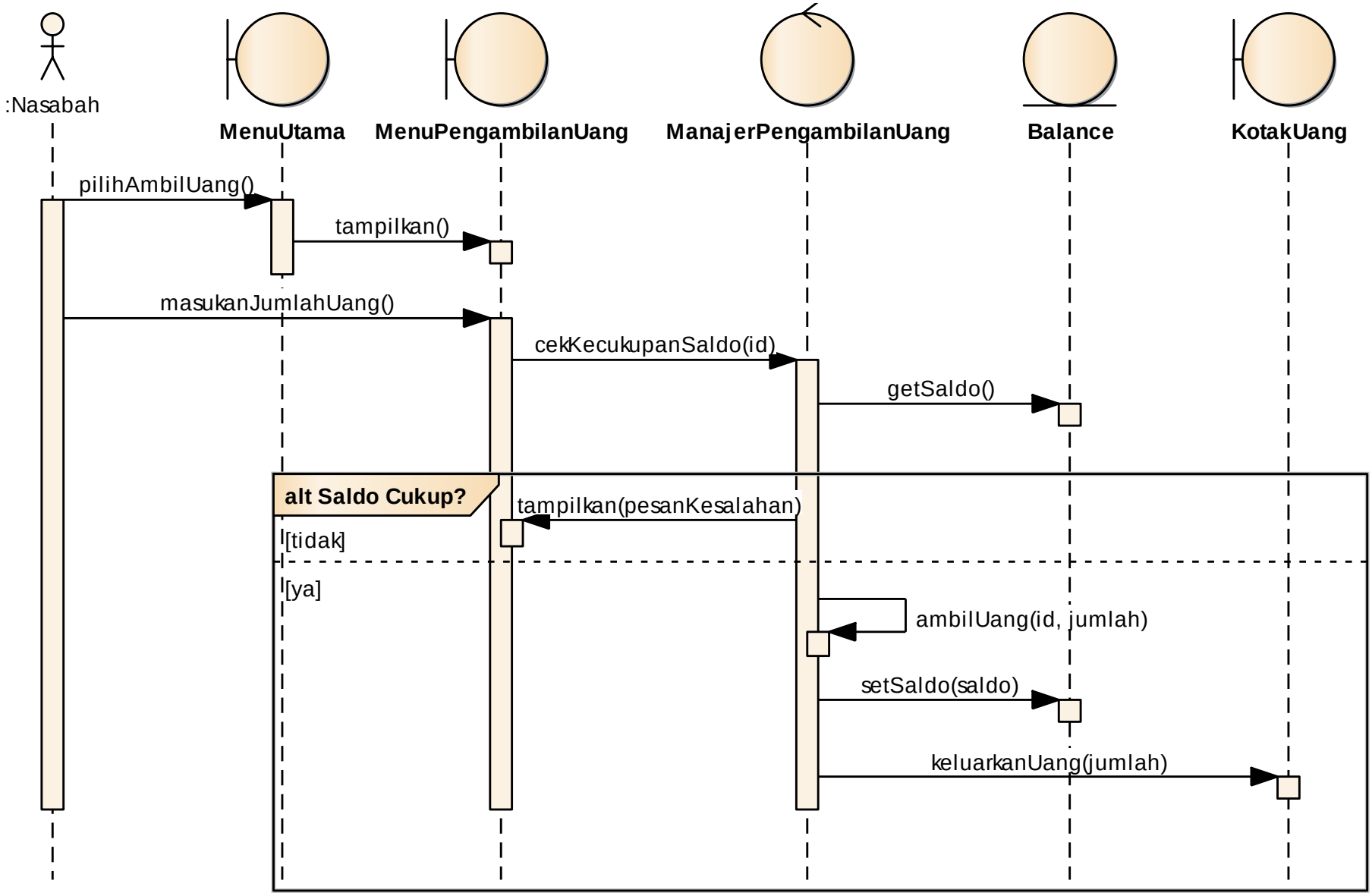
Sequence Diagram: Memasukkan PIN



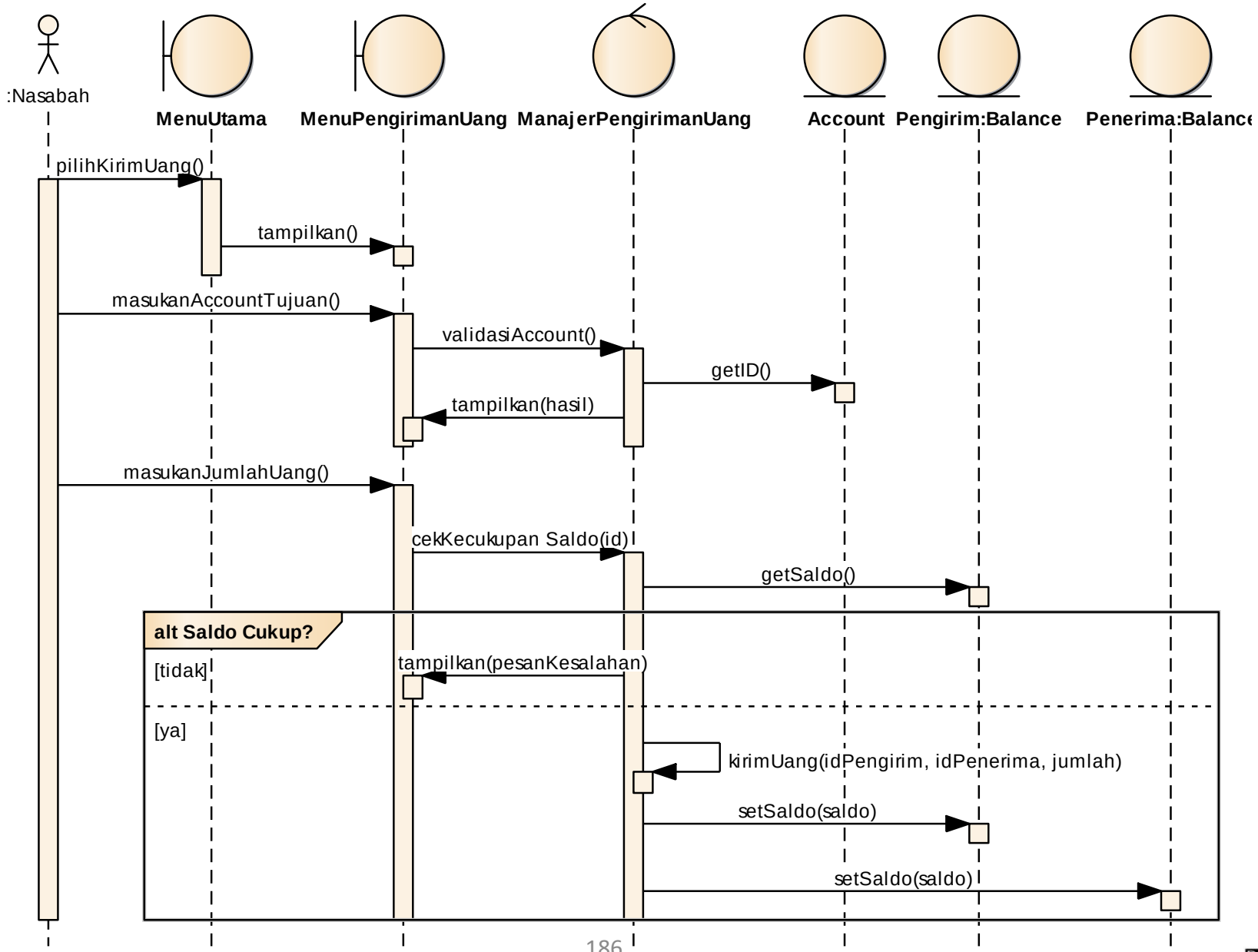
Sequence Diagram: Mengecek Saldo



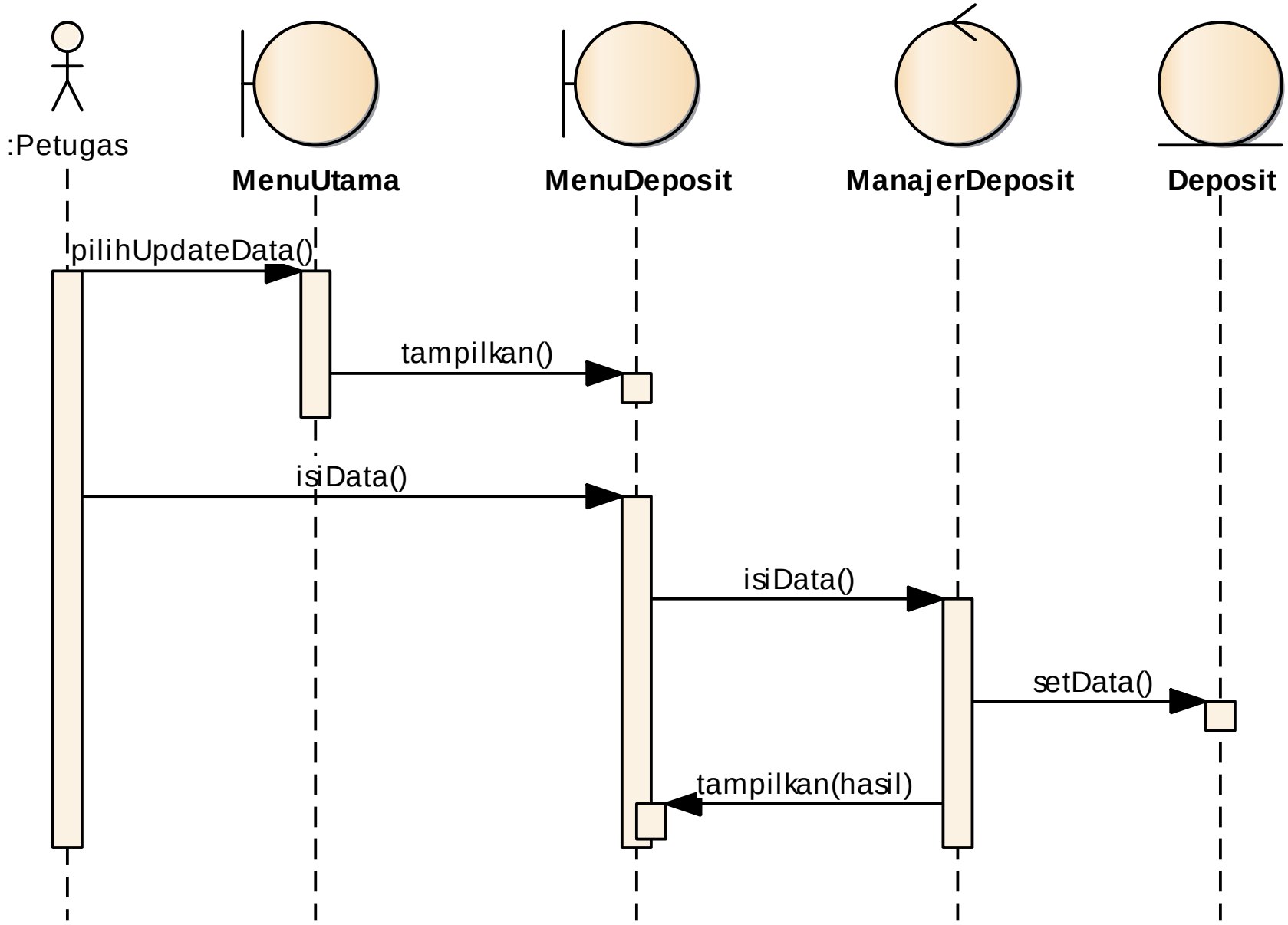
Sequence Diagram: Mengambil Uang



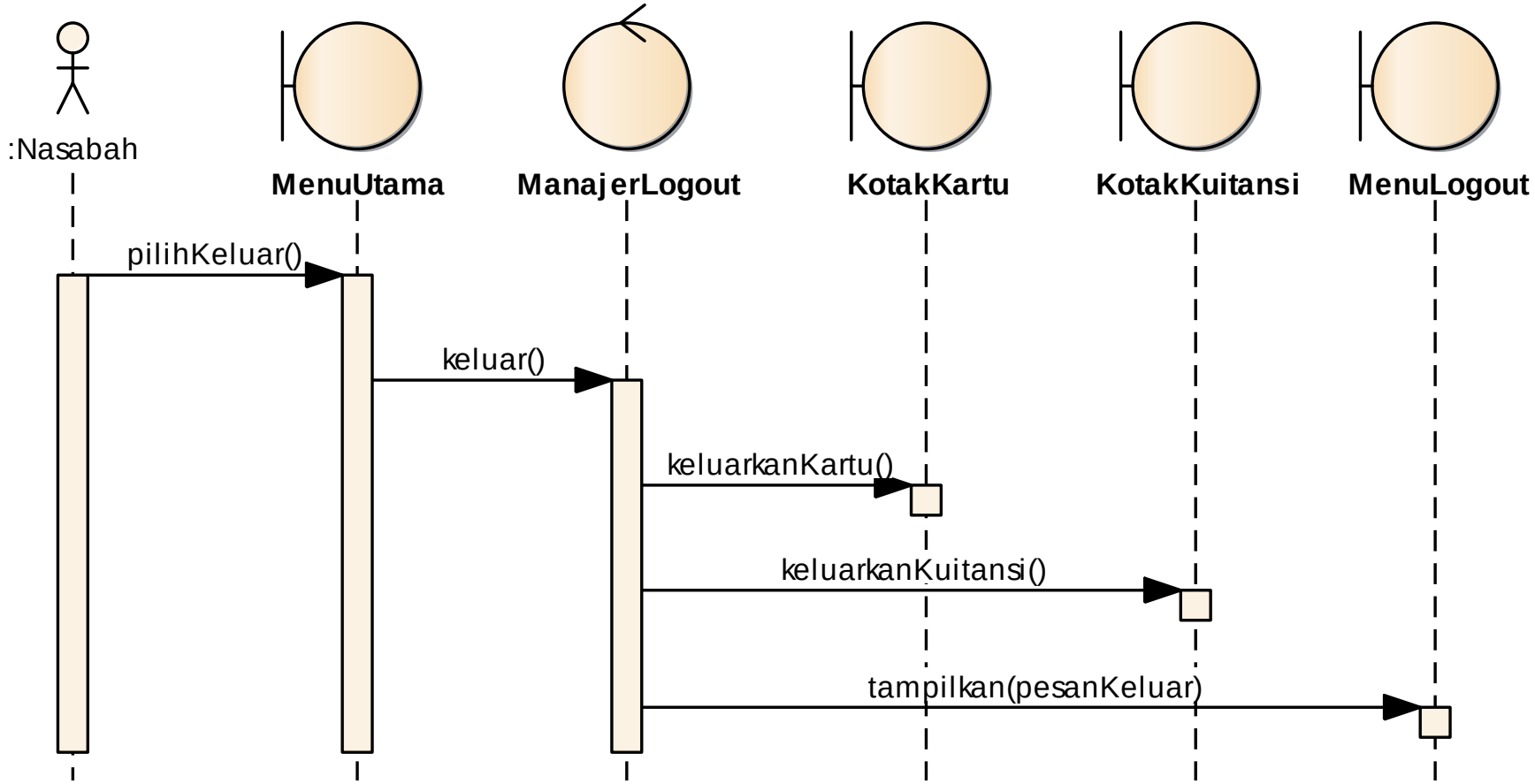
Sequence Diagram: Mengirim Uang



Sequence Diagram: Mengupdate Informasi Kotak Deposit

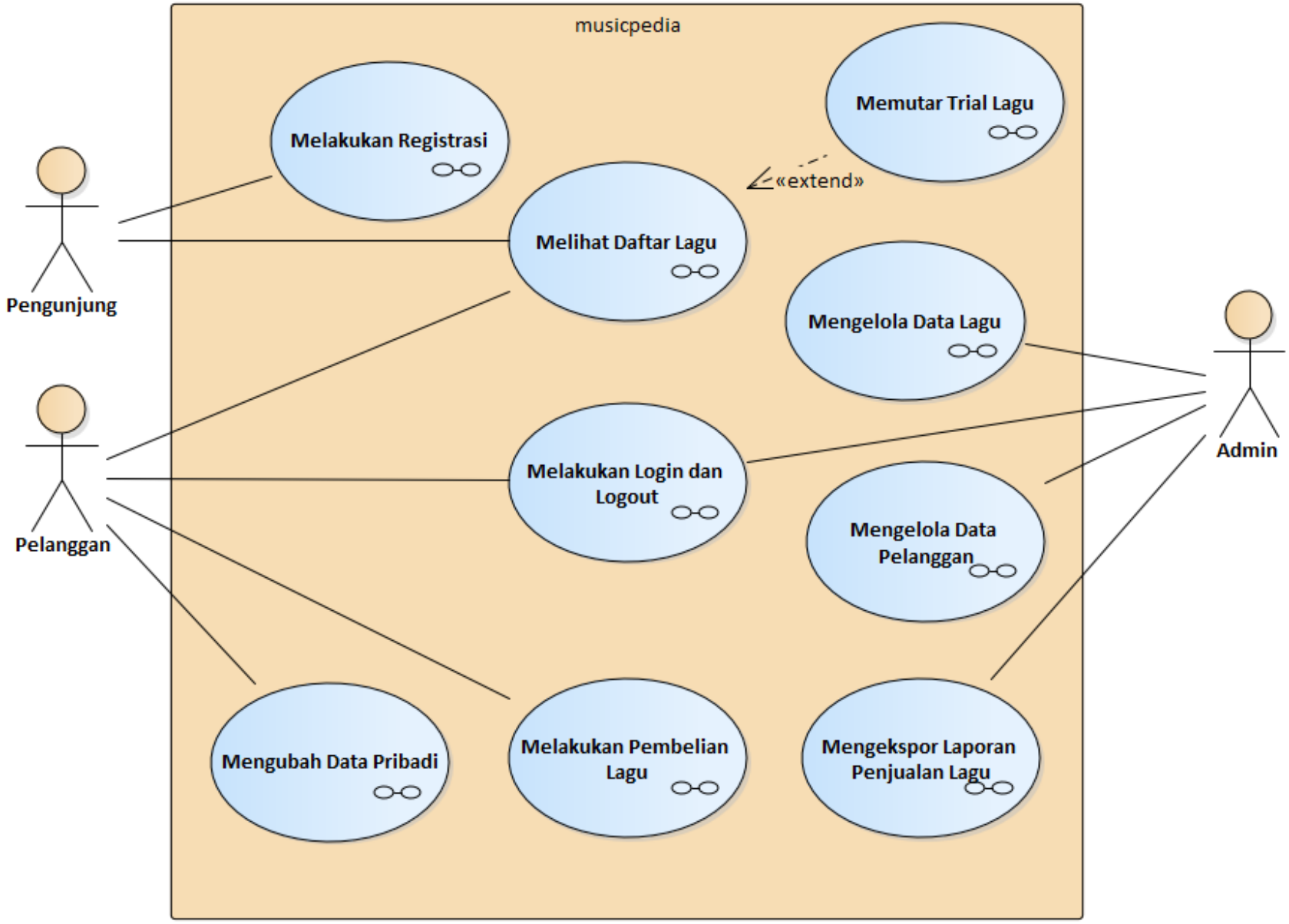


Sequence Diagram: Keluar Sistem

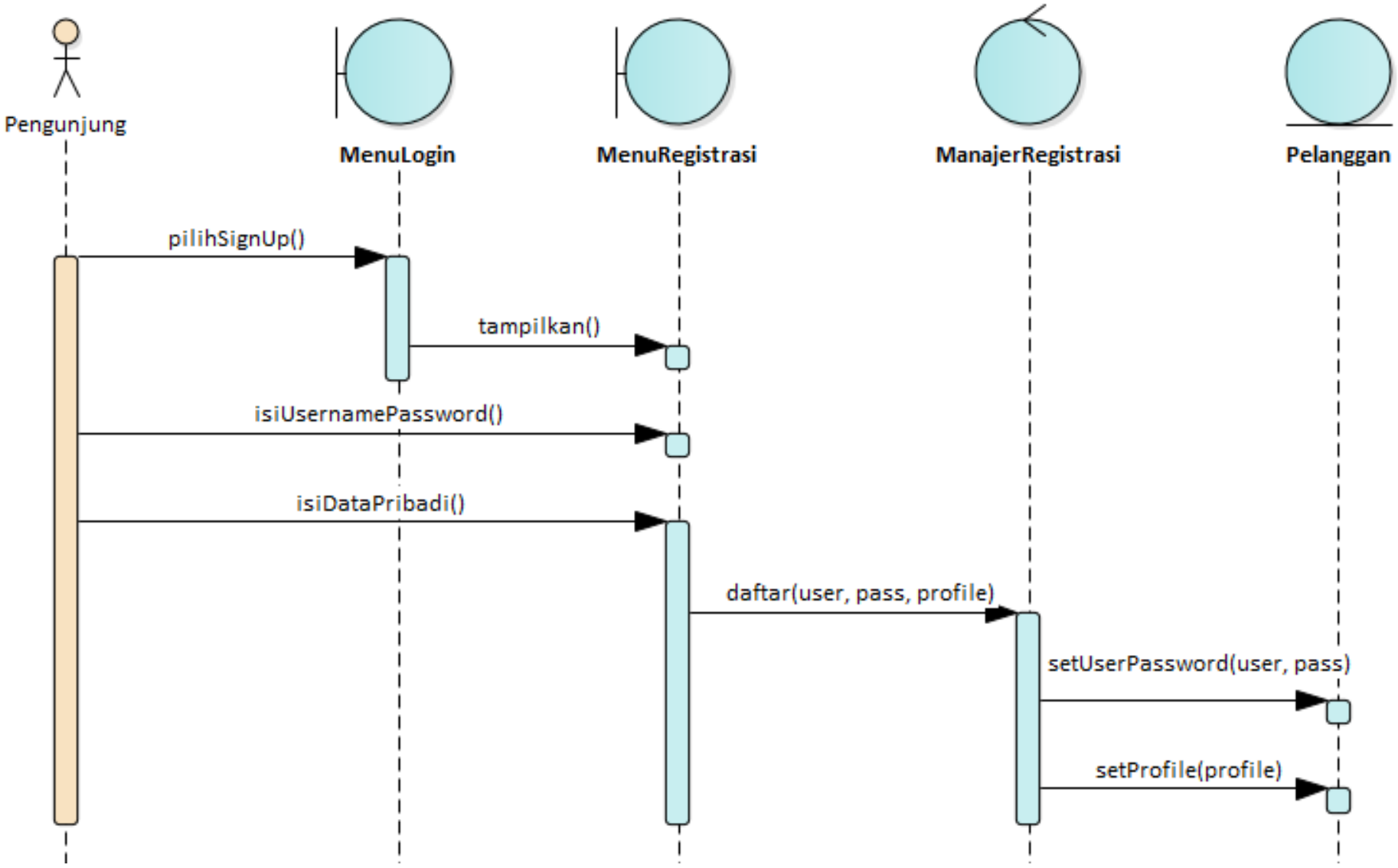


Studi Kasus: Sequence Diagram MusicPedia

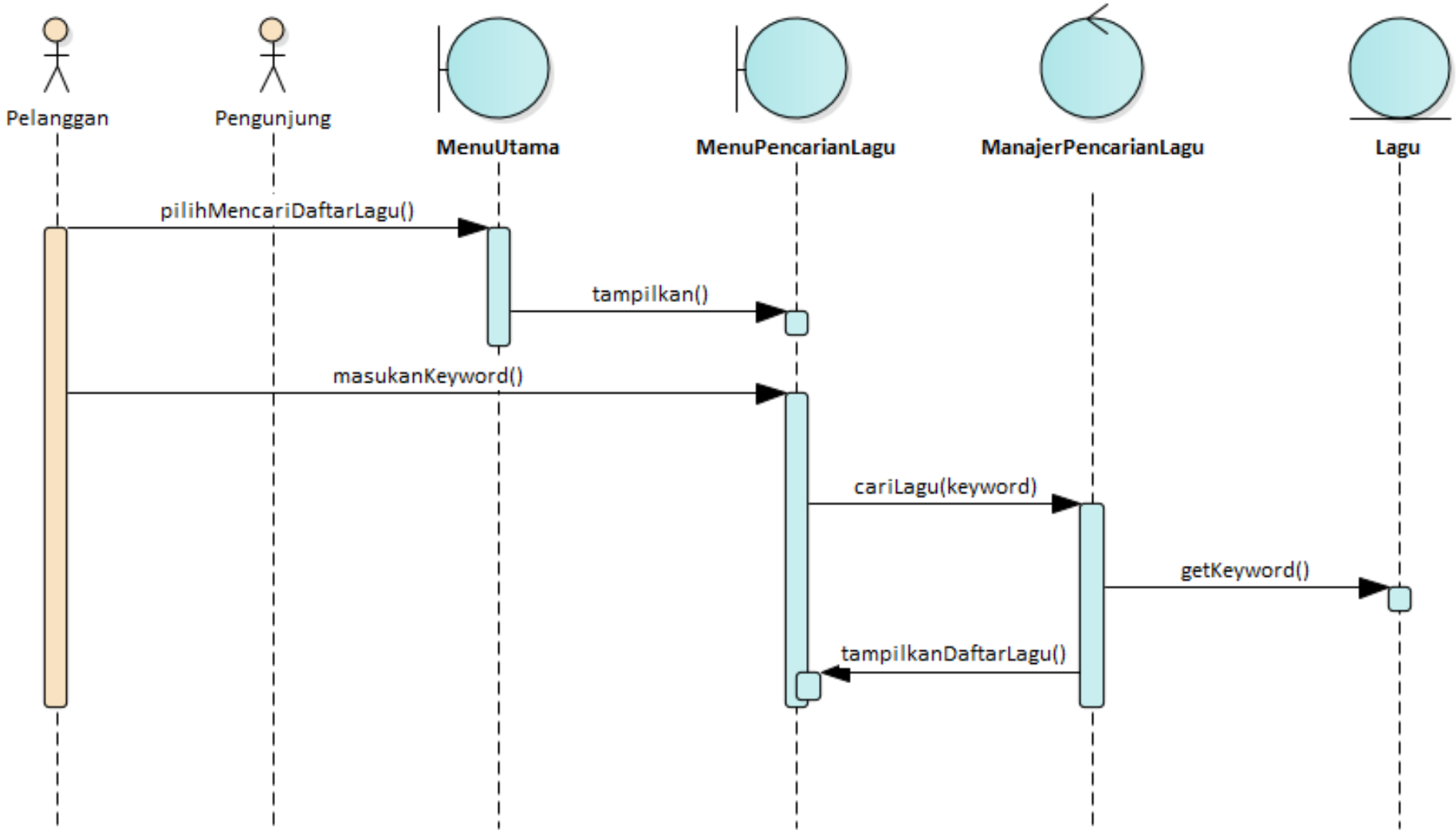
Use Case Diagram MusicPedia



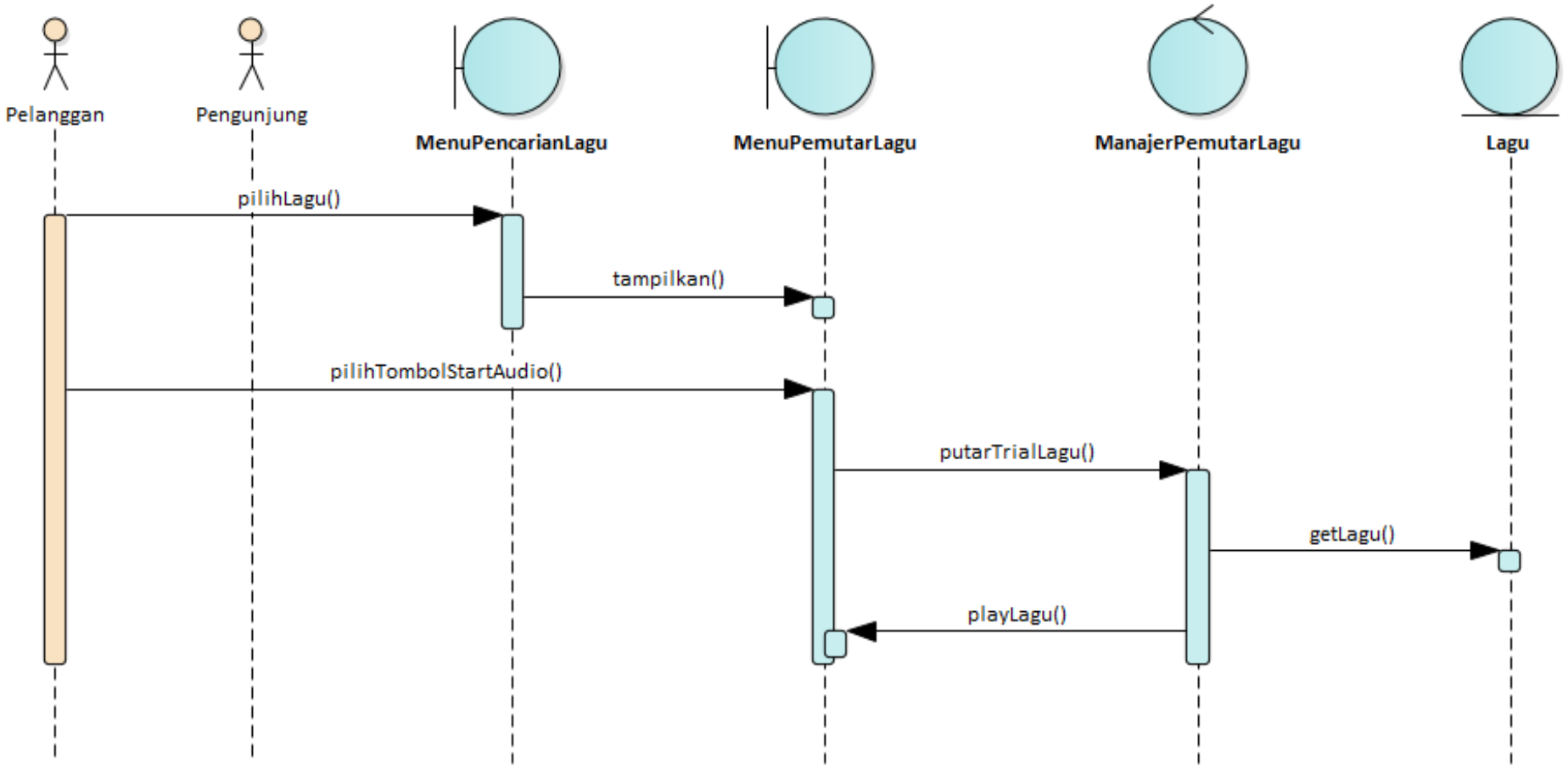
Sequence Diagram: Melakukan Registrasi



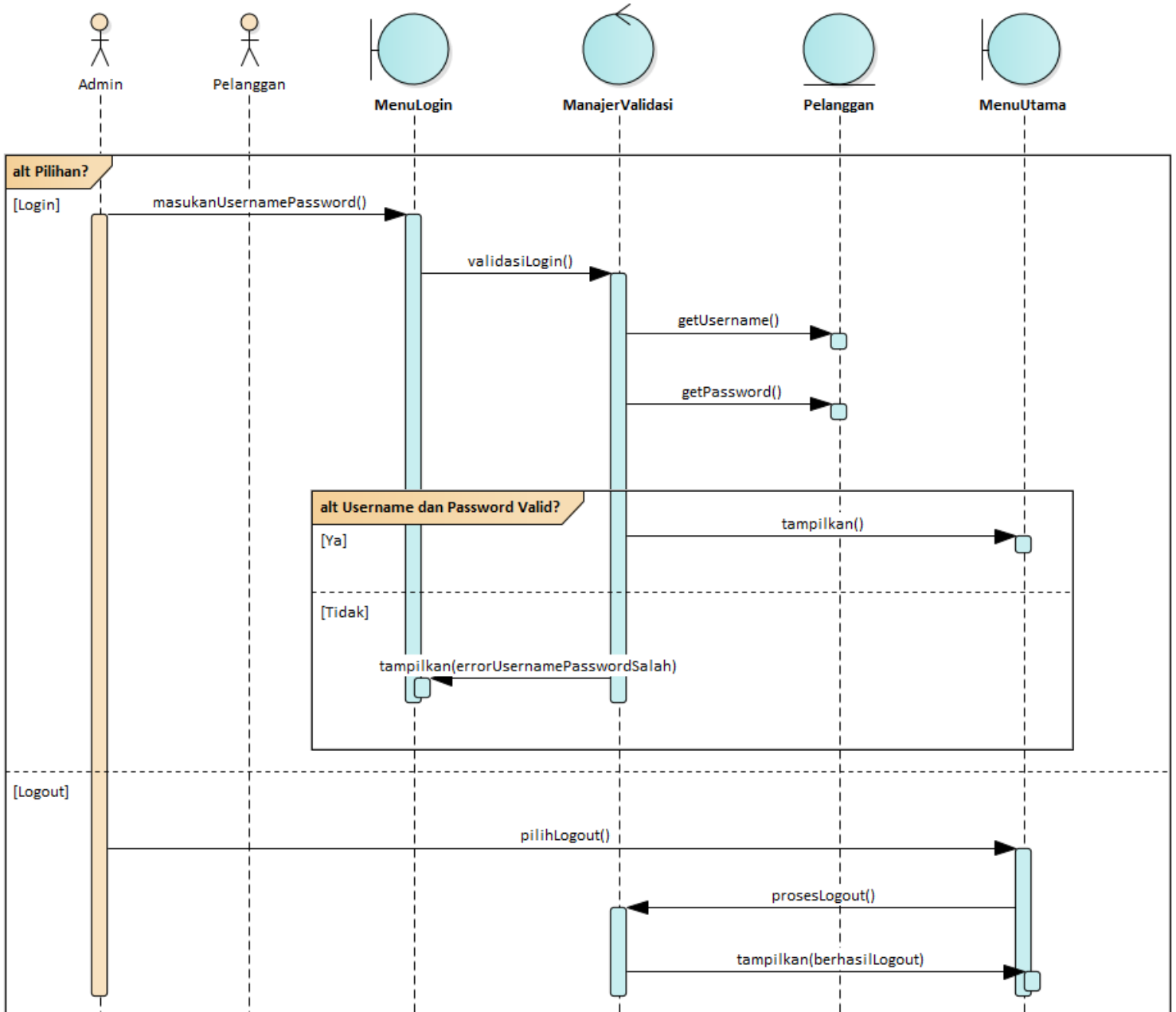
Sequence Diagram: Melihat Daftar Lagu



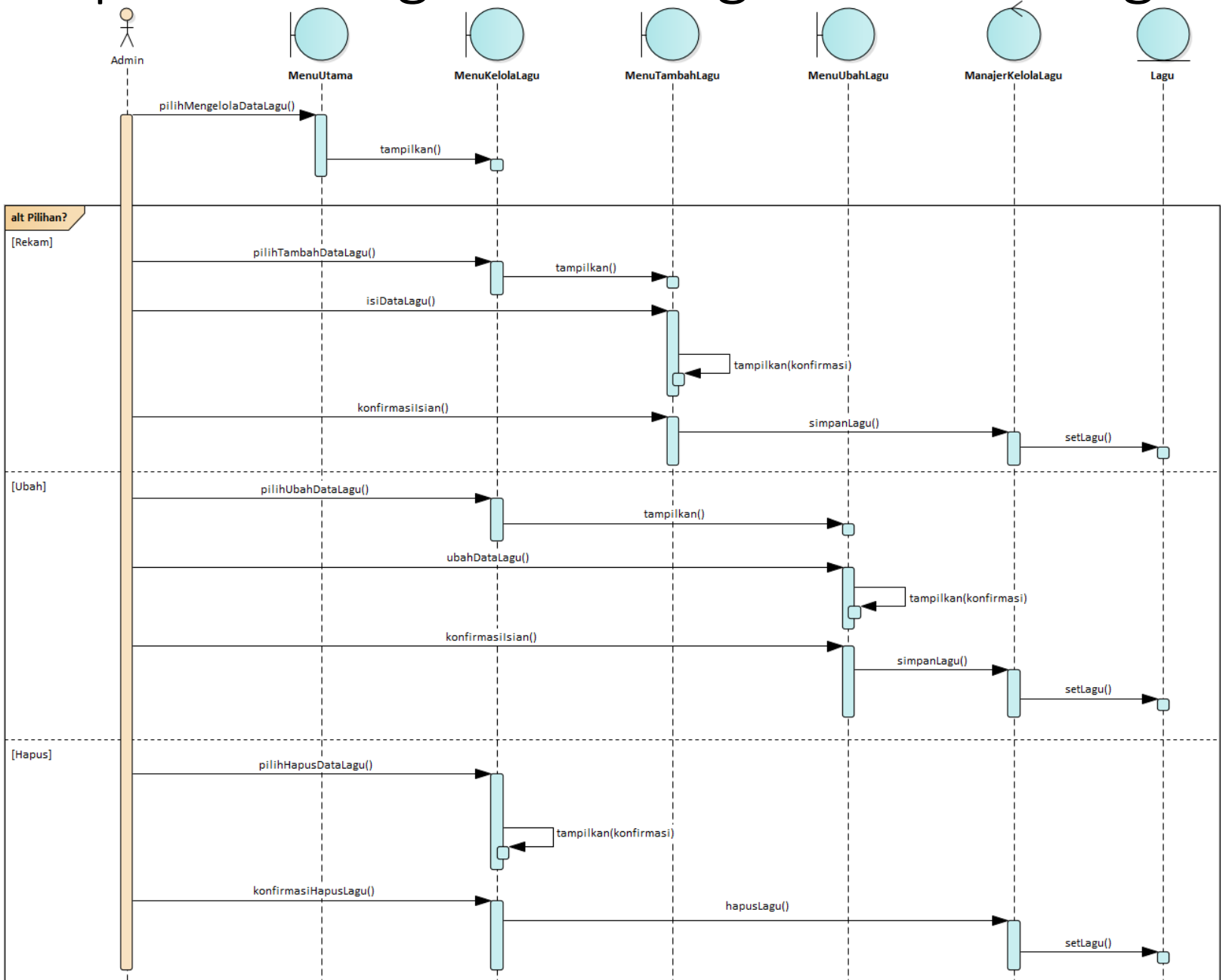
Sequence Diagram: Memutar Trial Lagu



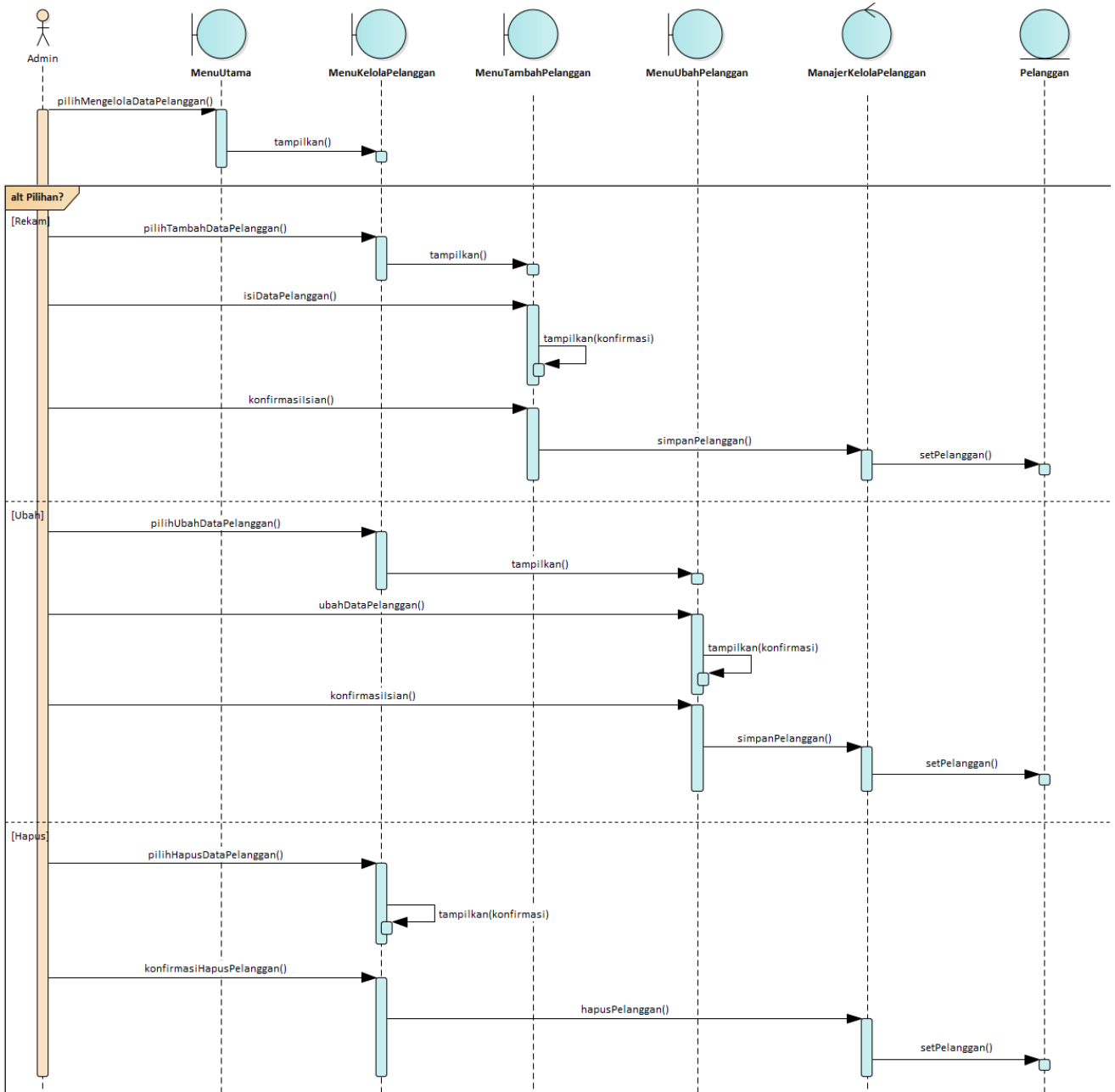
Sequence Diagram: Melakukan Login dan Logout



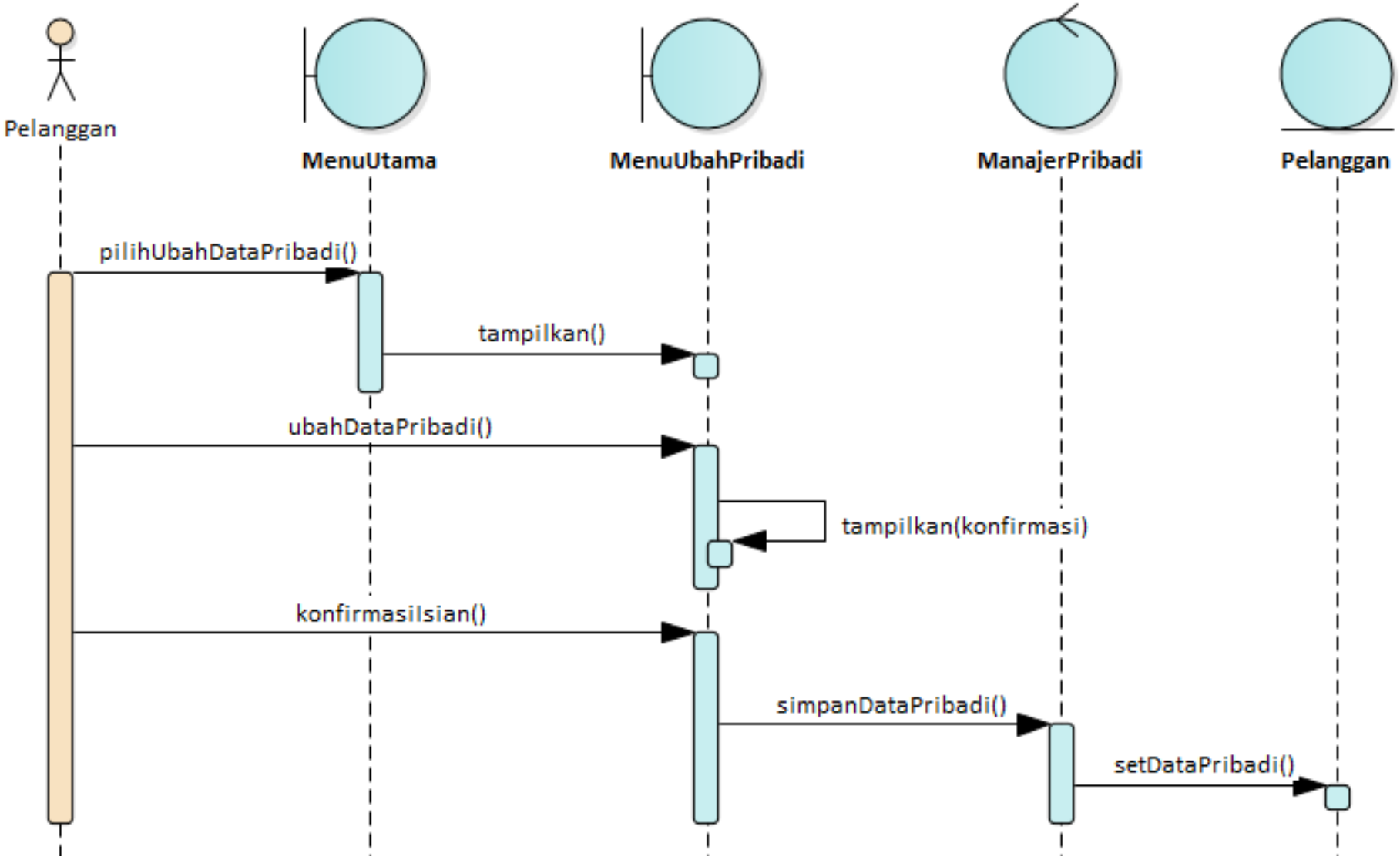
Sequence Diagram: Mengelola Data Lagu



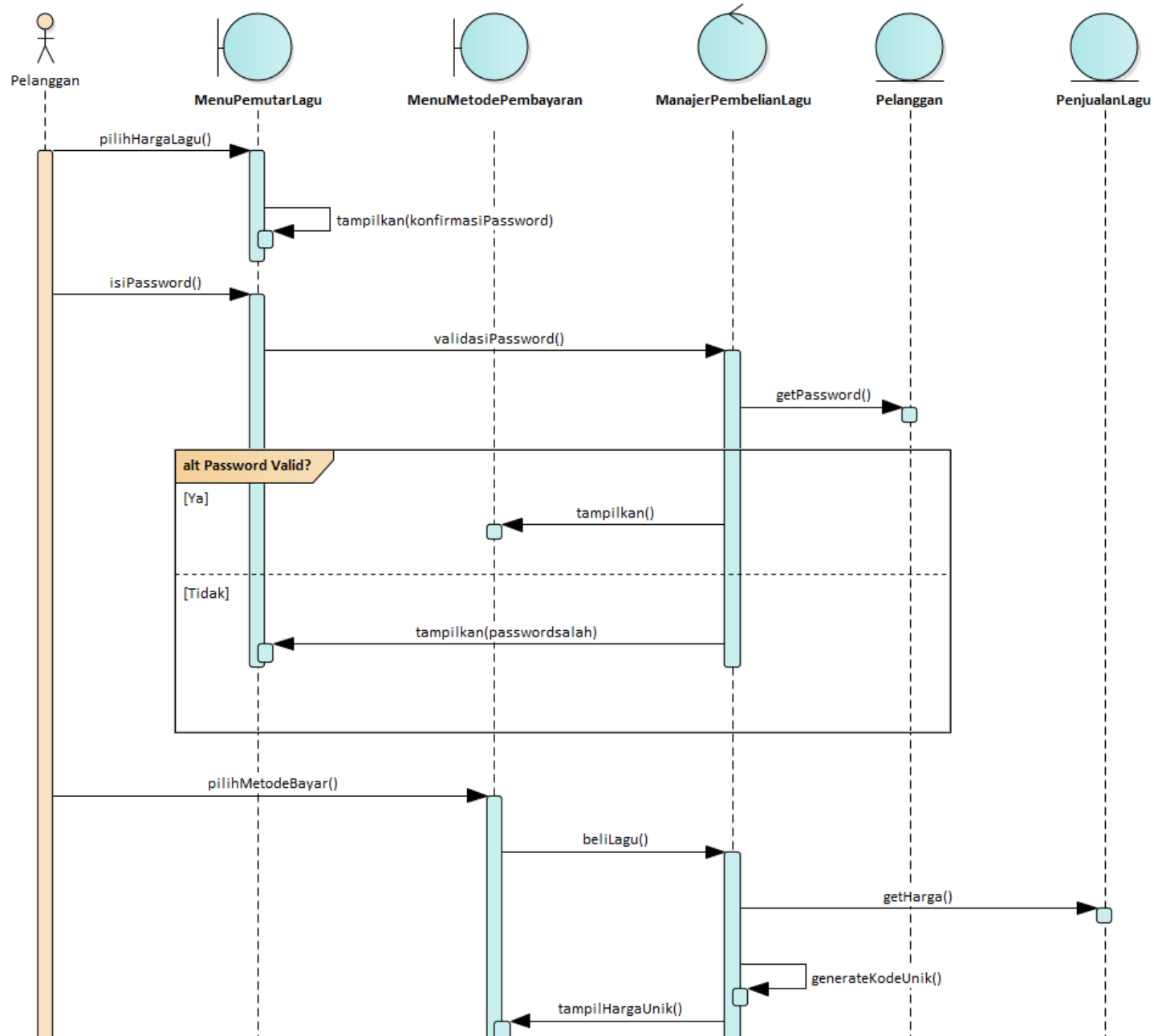
Sequence Diagram: Mengelola Data Pelanggan



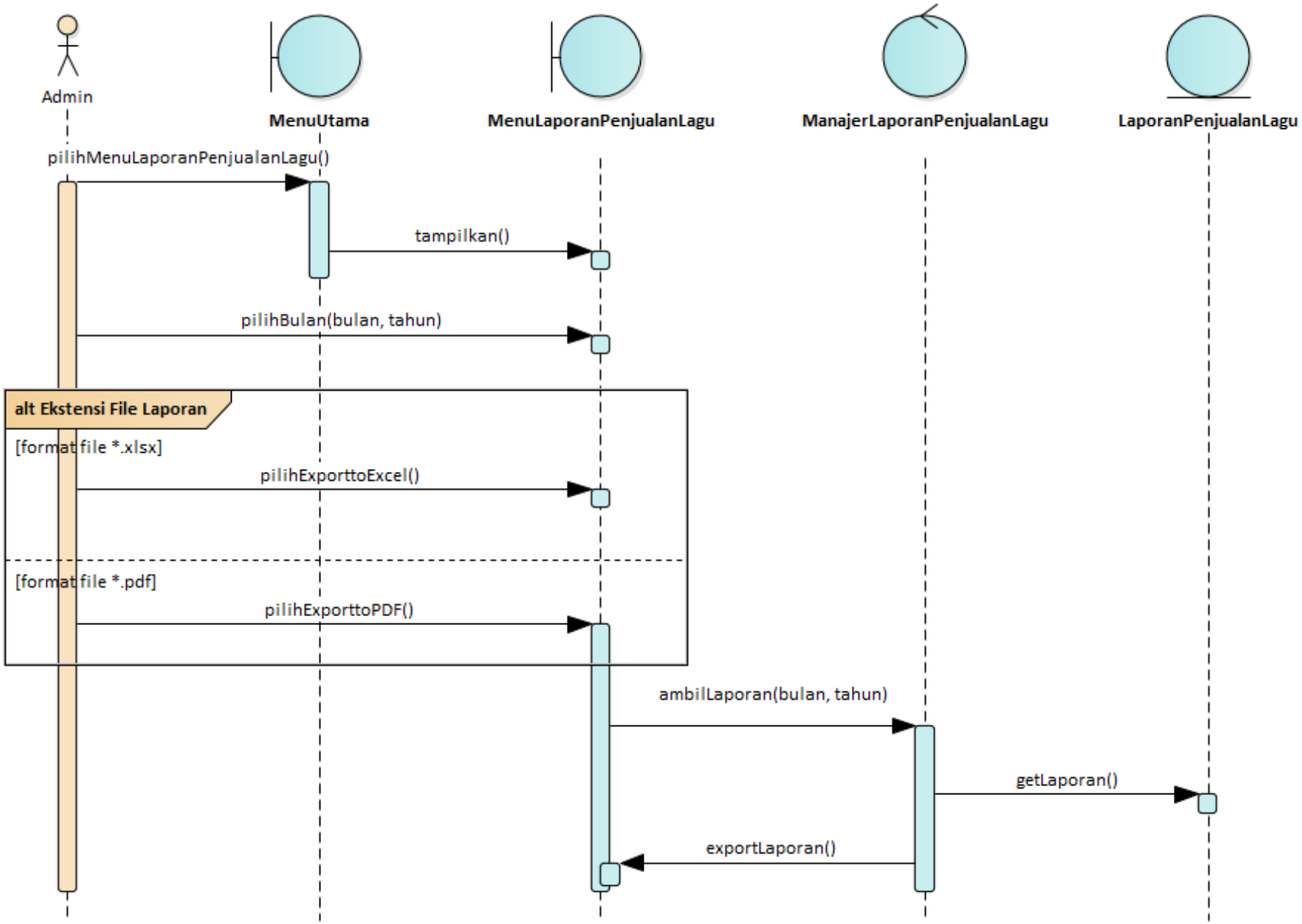
Sequence Diagram: Mengubah Data Pribadi



Sequence Diagram: Melakukan Pembelian Lagu



Sequence Diagram: Mengekspor Laporan Penjualan

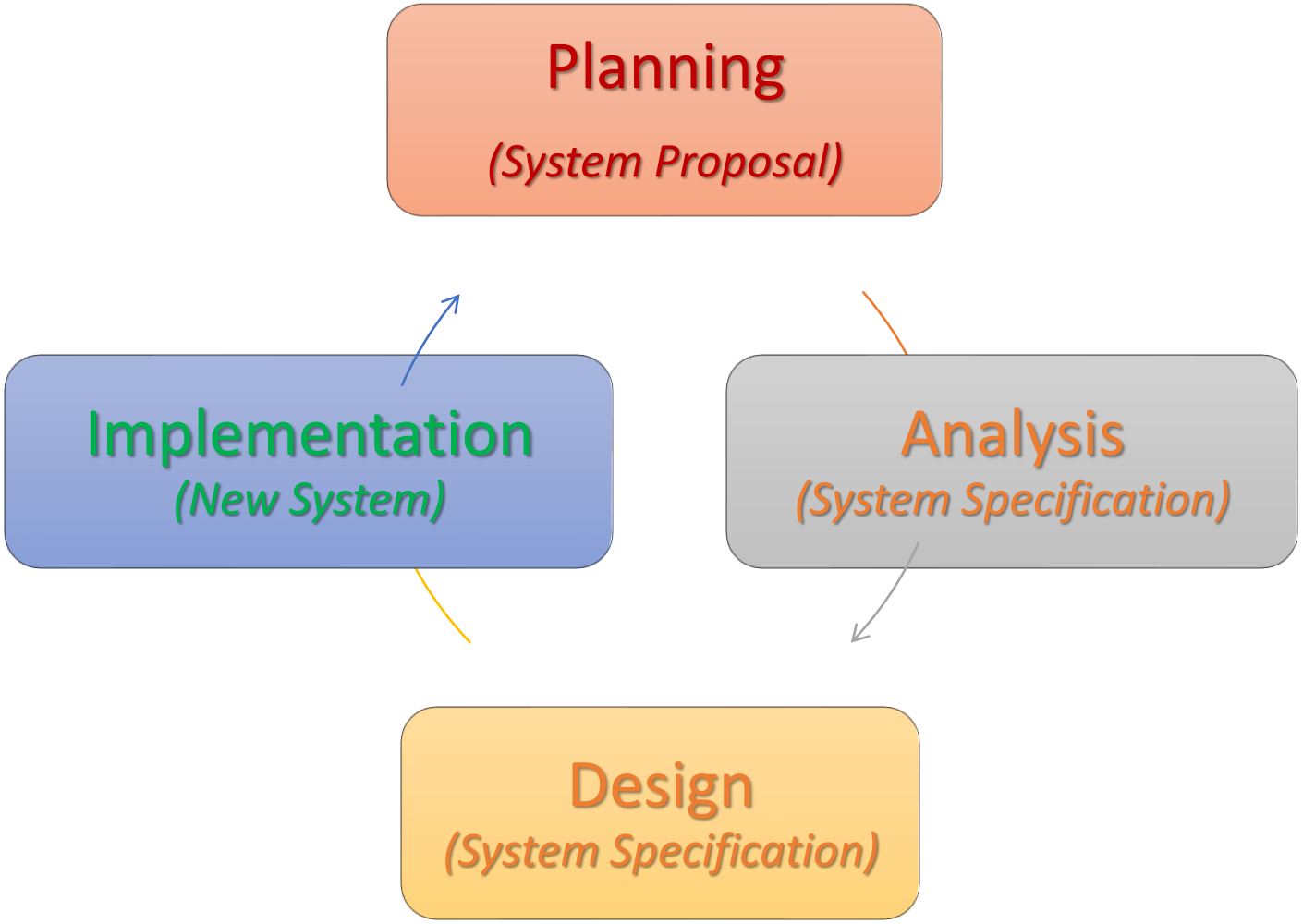


Catatan Pola Kesalahan

- Gunakan pola Subject-Verb-Object (S-V-O) untuk use case diagram (Actor – Use Case) dan Activity Diagram (Partition – Action)
- Use Case Diagram adalah apa yang dilakukan Actor di sistem, bukan apa yang dilakukan oleh sistem
- Pada Sequence Diagram perhatikan transaksi yang harusnya datangnya dari actor, dan bukan dari object lain
- Naming untuk object dan class adalah kata benda (noun), untuk message di Sequence Diagram (method) adalah kata kerja
- Object lifeline dan message di Sequence Diagram dan nama class di Class Diagram, tidak boleh menggunakan spasi, karena akan jadi Class dan Method di kode program
- Actor (manusia) akan mengirim message hanya ke Boundary Class, tidak ke Control atau Entity Class. Sedangkan Actor (System) akan mengirim message ke Control
- Entity Class bukan consumer, jadi tidak pernah mengirim message ke Boundary atau Control Class
- Boundary class akan menjadi UI Design, entity class akan menjadi Data Model
- Class diagram tidak menunjukkan alur, tapi menunjukkan struktur dan komposisi dari sistem yg kita bangun

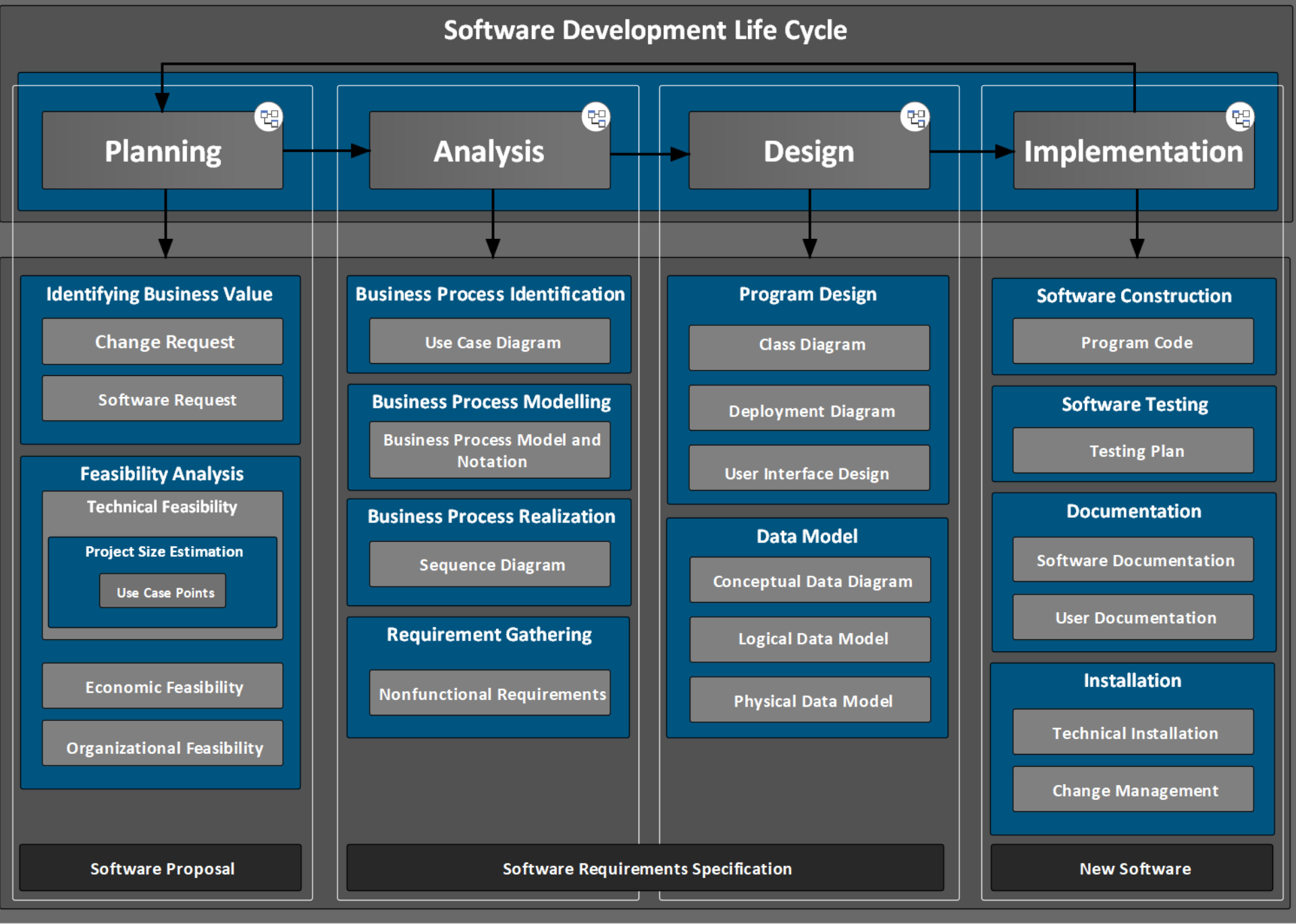
3. Systems Design

Siklus Pengembangan Software



(Tilley, 2012) *(Dennis, 2016)* *(Valacich, 2017)*

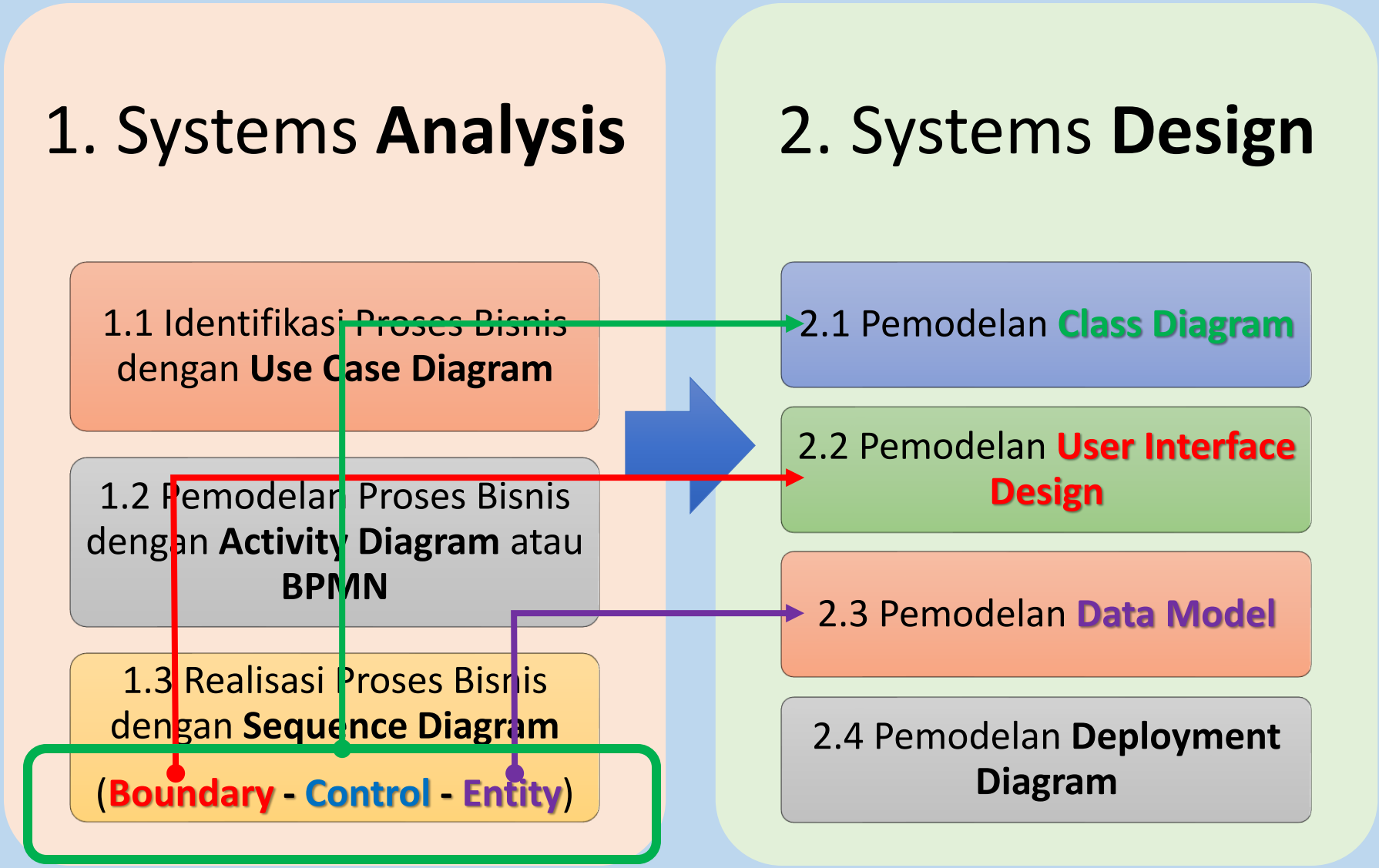
Application Development Governance



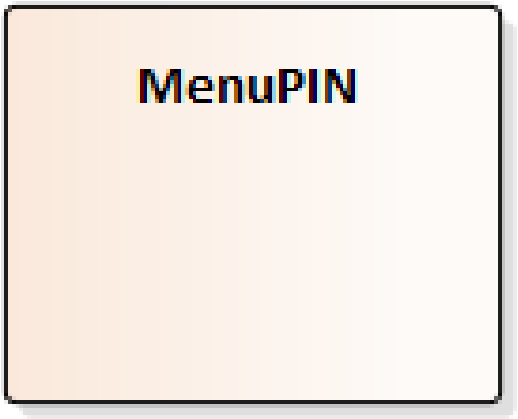
3.1 Perancangan Class Diagram

UML based Software Analysis and Design

(Wahono, 2009)



Class

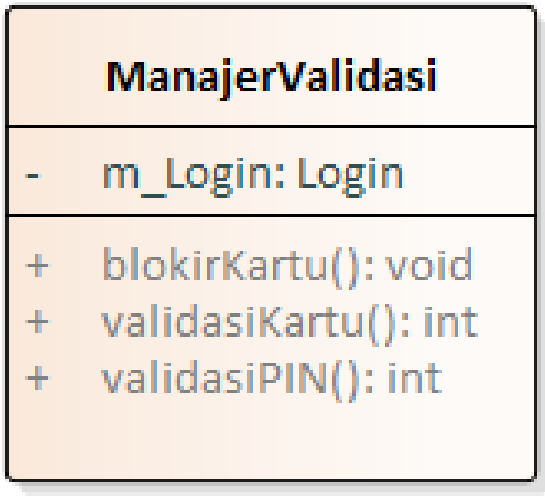



```
public class MenuPIN{

    ........

}
```

Attributes

- Visibility of attributes
  - **+ Public**: not hidden from any object
  - **# Protected**: hidden from all but immediate subclasses
  - **– Private**: hidden from all other classes
- Default is private

Class with Attribute and Method

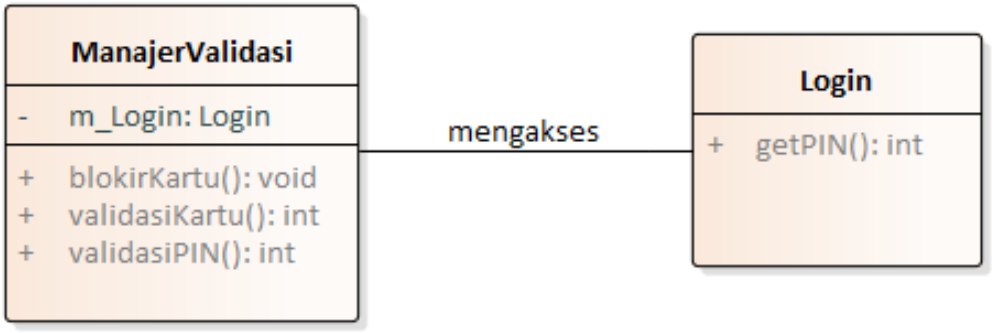


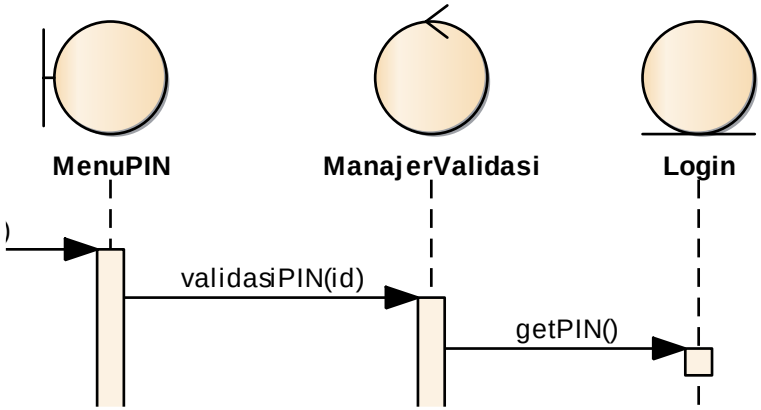

```
public class ManajerValidasi {

        private Login m_Login;

        public int validasiKartu(){
            return 0;
         }

         public int validasiPIN(){
            return 0;
         }

          public void blokirKartu(){

          }
   }
```

Relationships

1. Generalization
   - "Is-A" relationship
   - Enables inheritance of attributes & operations
   - Subclasses and superclasses
2. Aggregation
   - "Has-A" relationship
   - Relates parts to wholes
   - Uses decomposition
3. Composition
   - "Has-A" relationship
   - Similar but stronger than Aggregation
4. Association
   - Relationships that don't fit "Is-A" or "Has-A"
   - Often a weaker form of "Has-A"
   - Miscellaneous relationships between classes

Class Association

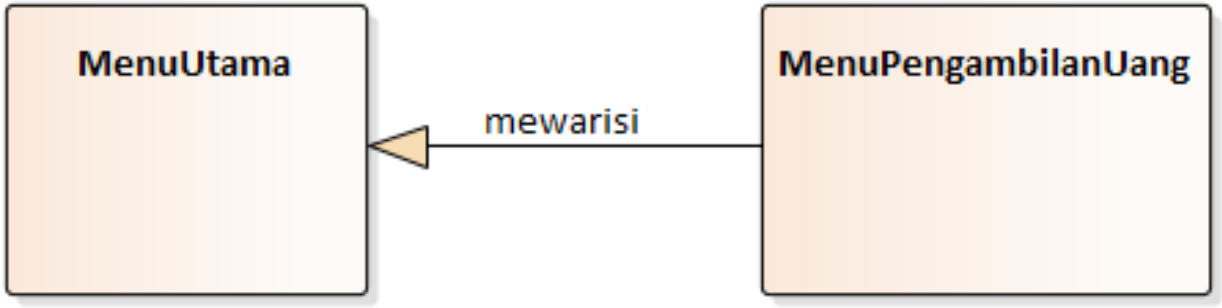





```
public class ManajerValidasi {

        private Login m_Login;

        public int validasiKartu(){
              return 0;
         }

         public int validasiPIN(){
              int pin = m_login.getPIN();
              return 0;
        }

         public void blokirKartu(){

         }
}
```

```
public class Login {


        public int getPIN(){
              return 0;
         }

}
```

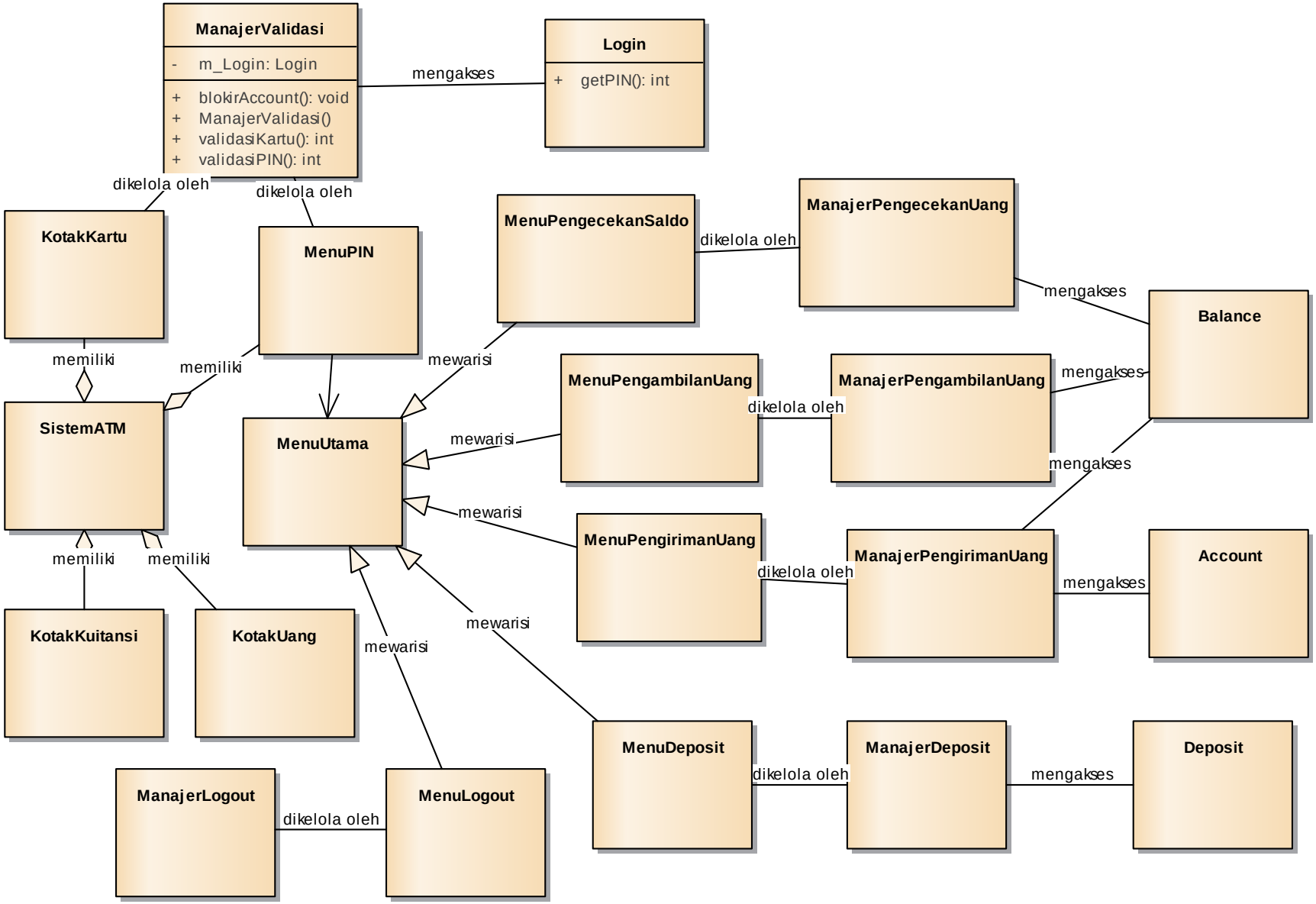
Class Inheritance



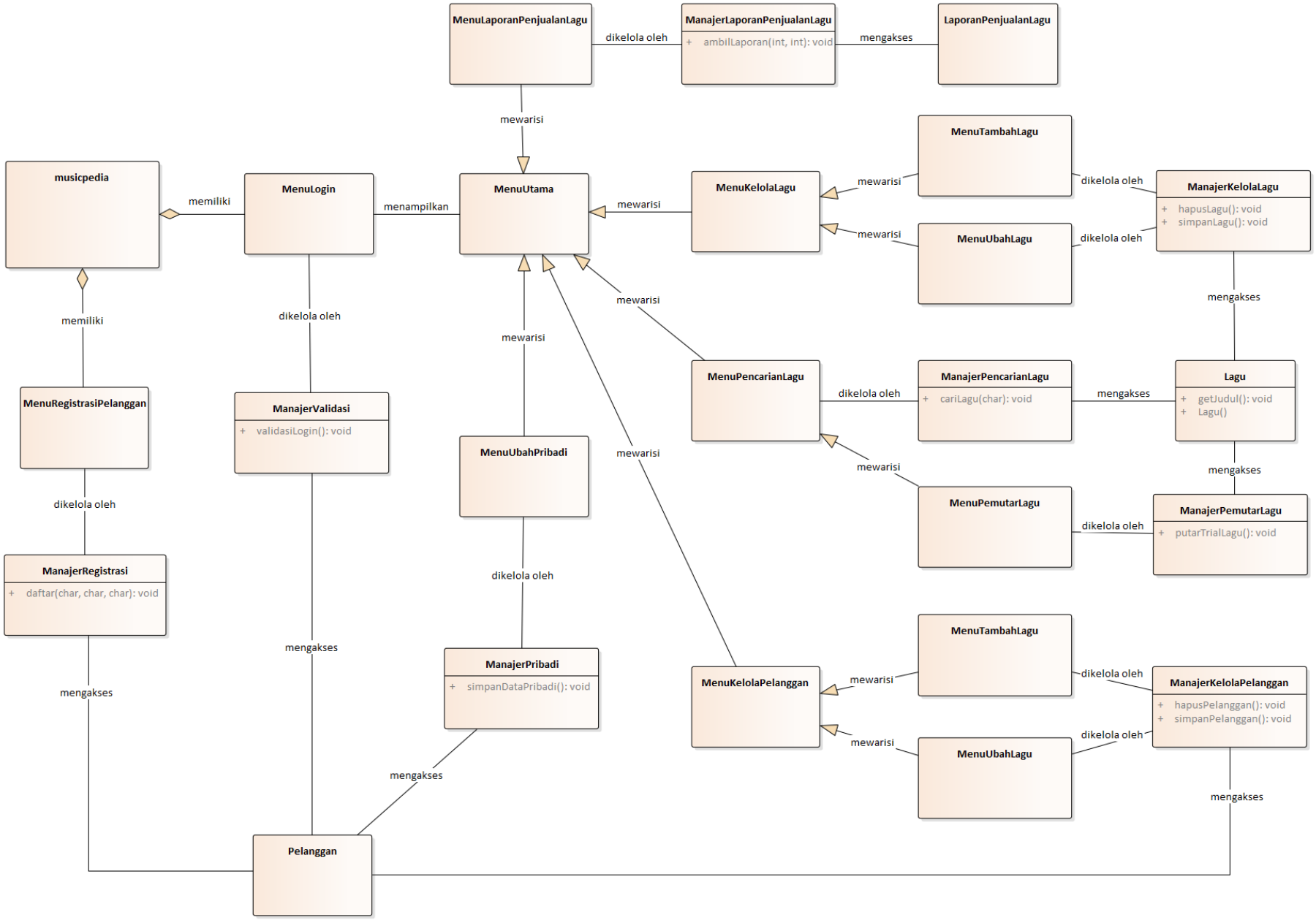

```
public class MenuUtama {

    ......

}
```

```
public class MenuPengambilanUang
        extends MenuUtama {

    .....

}
```

Class Diagram: Sistem ATM



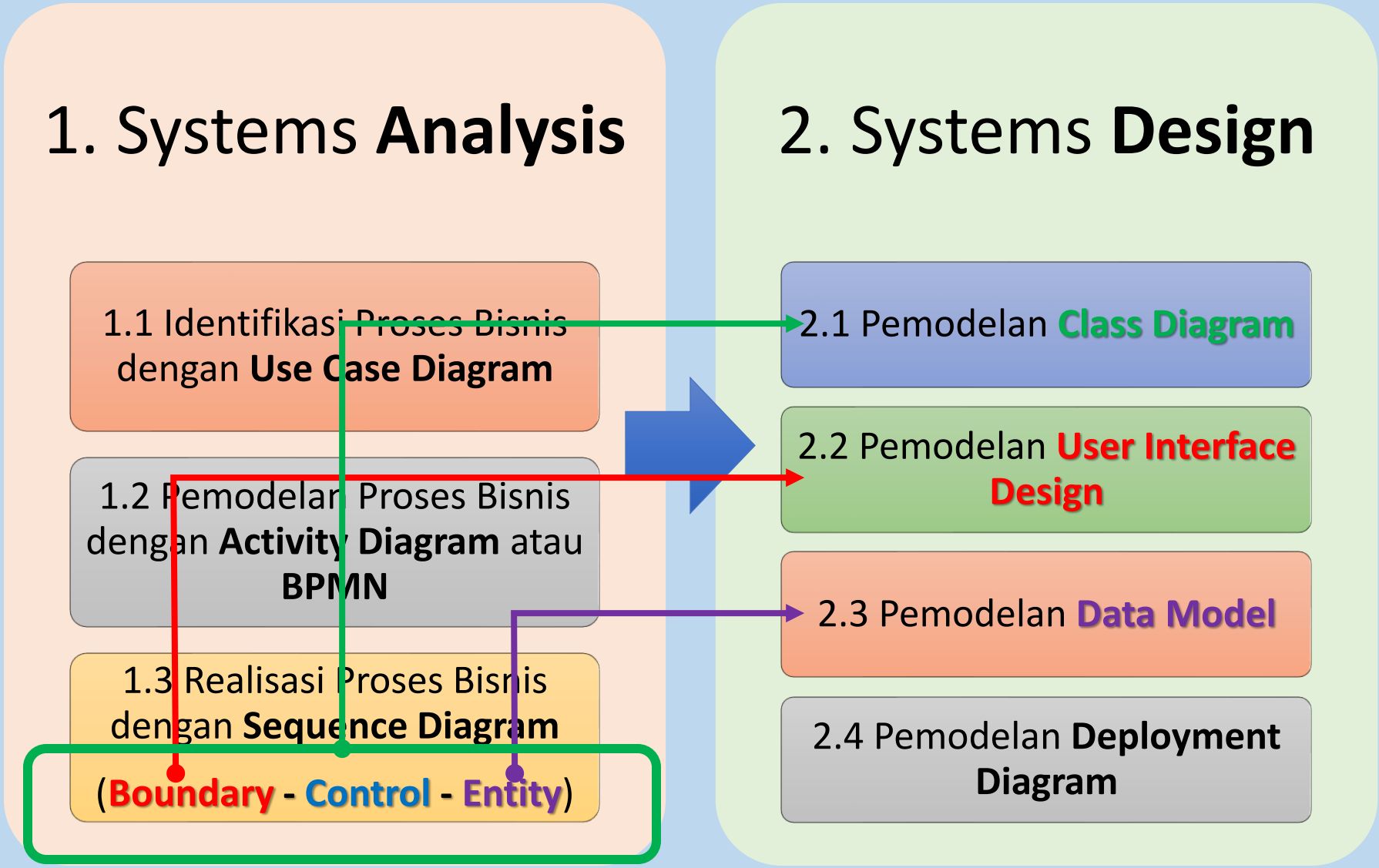
Class Diagram: MusicPedia



3.2 Perancangan User Interface Design

UML based Software Analysis and Design

(Wahono, 2009)

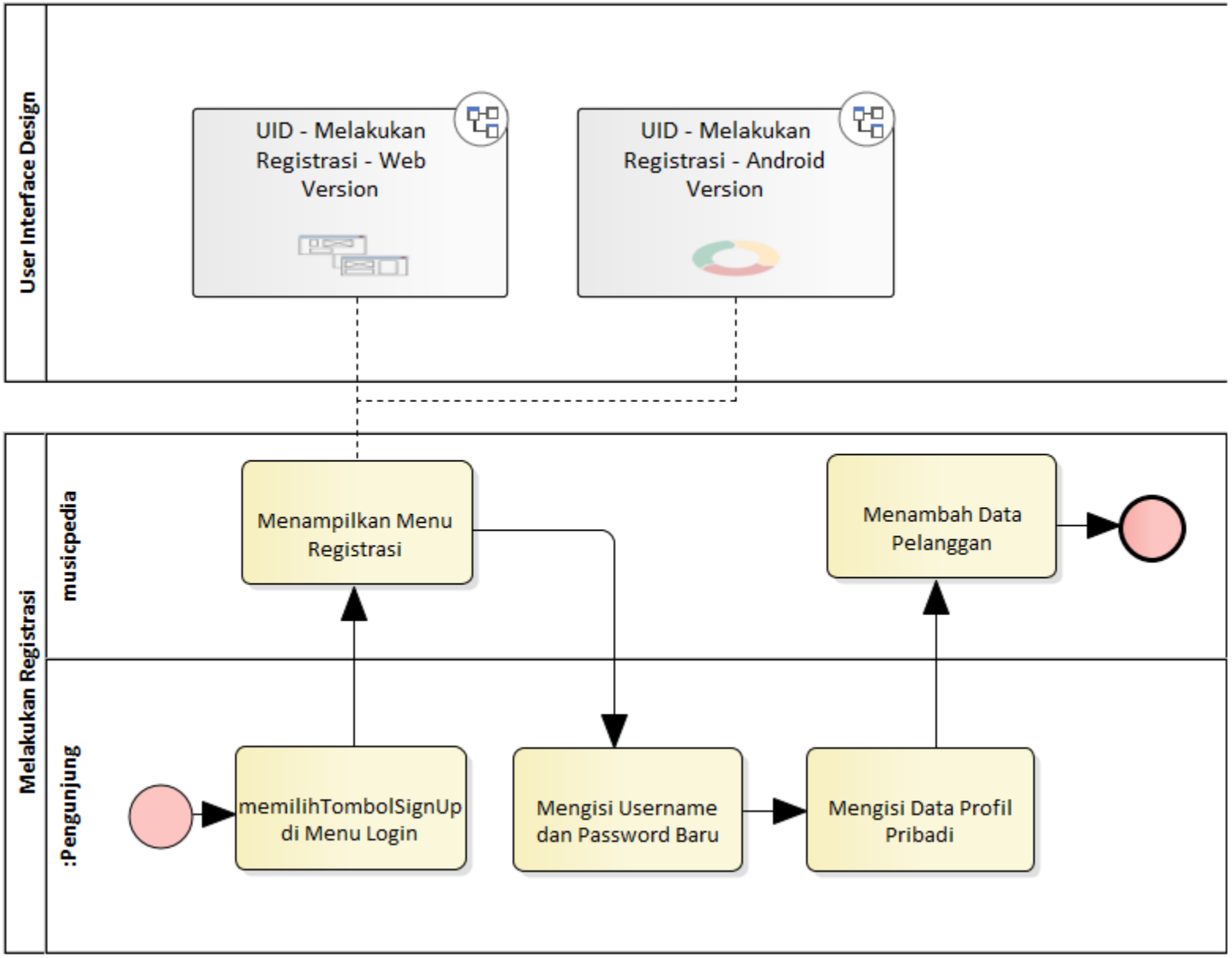


Philosophy and Principles

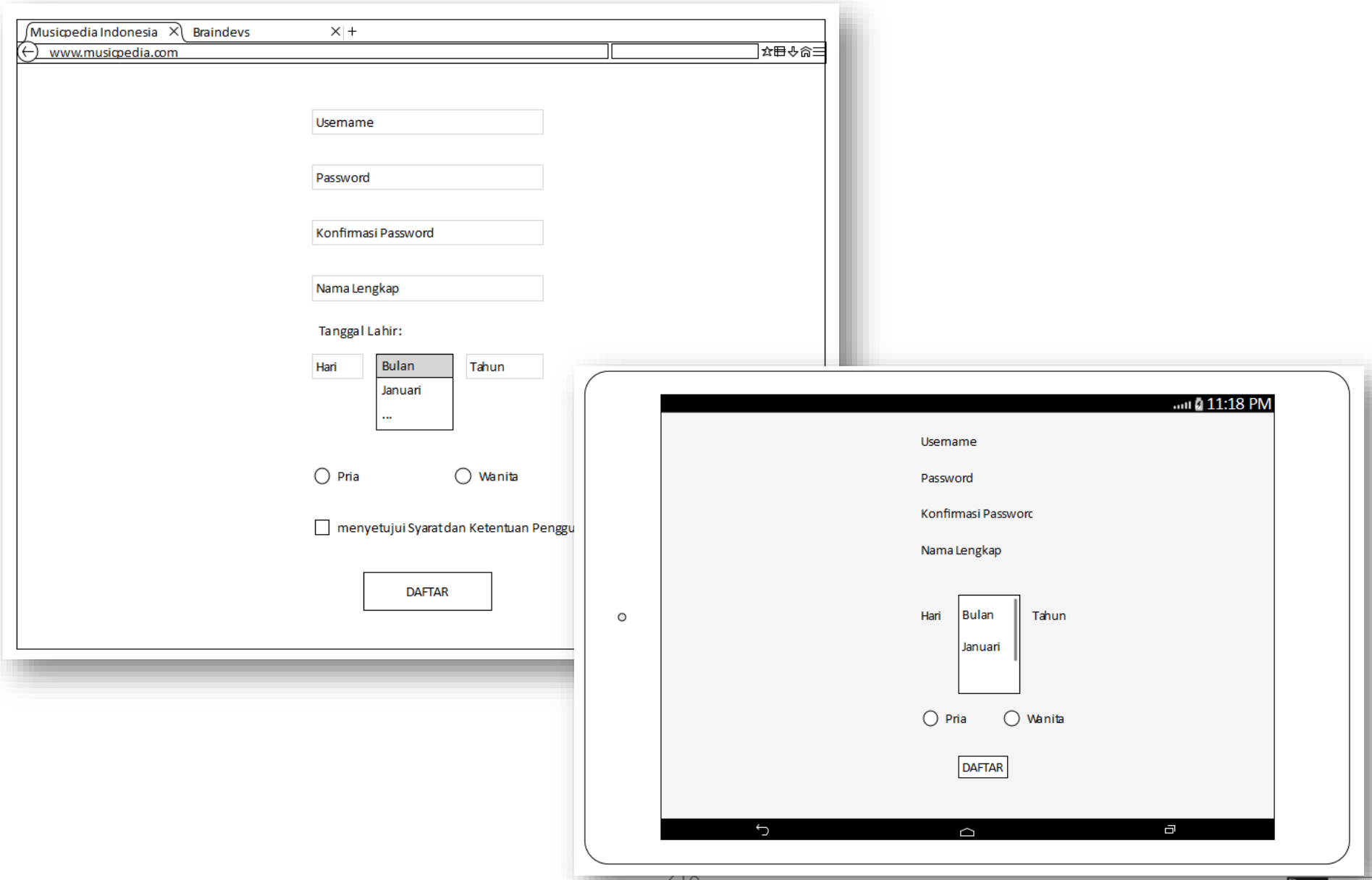
- Interface design is an art
- Balance between
  - Making the interface useful and
  - Presenting too much information

- Principles for User Interface Design:
  1. Layout: Consistent use of screen area
  2. Content awareness: Users know where they are
  3. Aesthetics: White space vs. functionality
  4. User experience: Ease of use vs. learning curve
  5. Consistency: User can predict what will happen for each action
  6. Minimal user effort: Simple to use, three click rule

BPMN Melakukan Registrasi



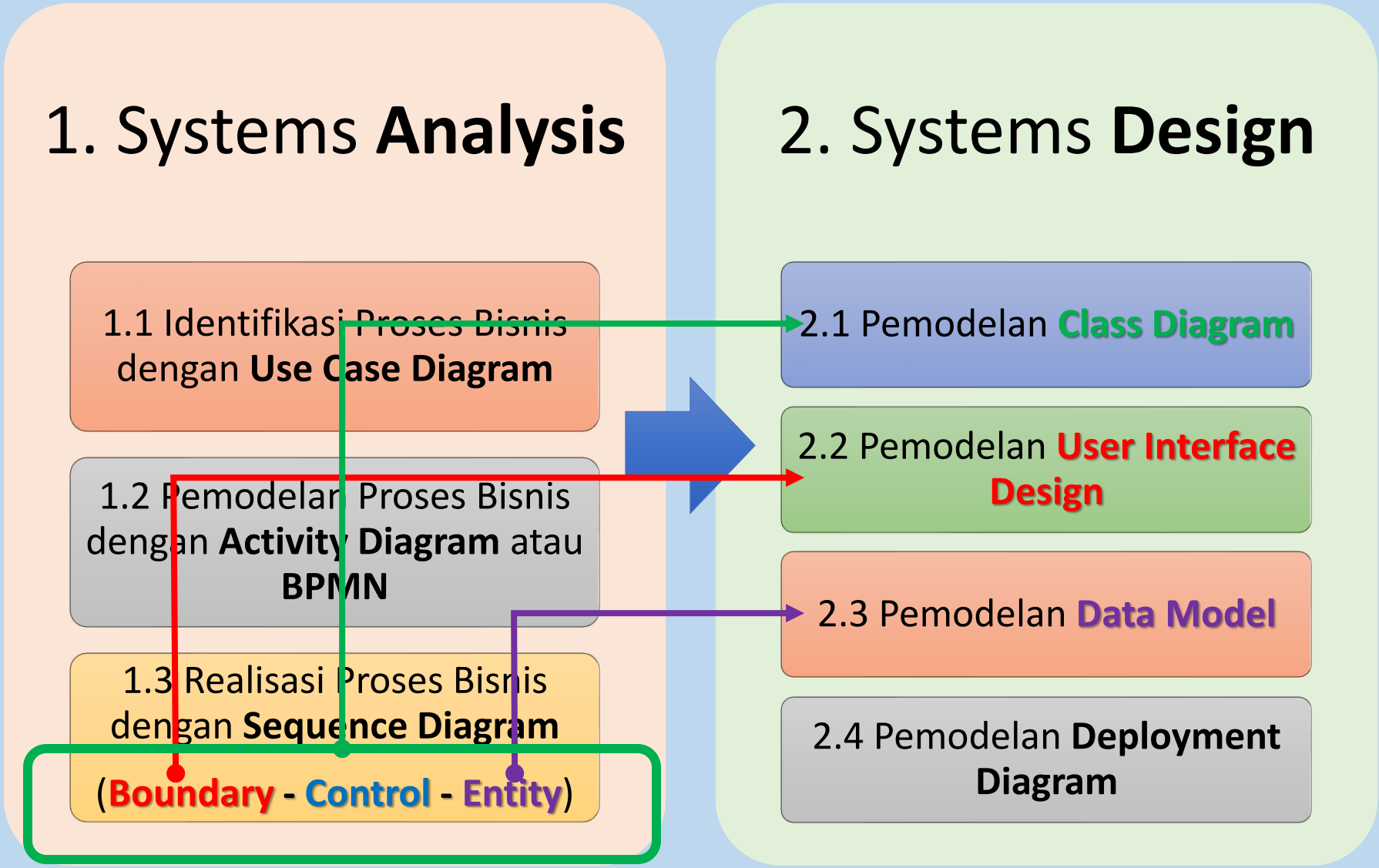
User Interface Design Melakukan Registrasi (versi Web dan versi Android)



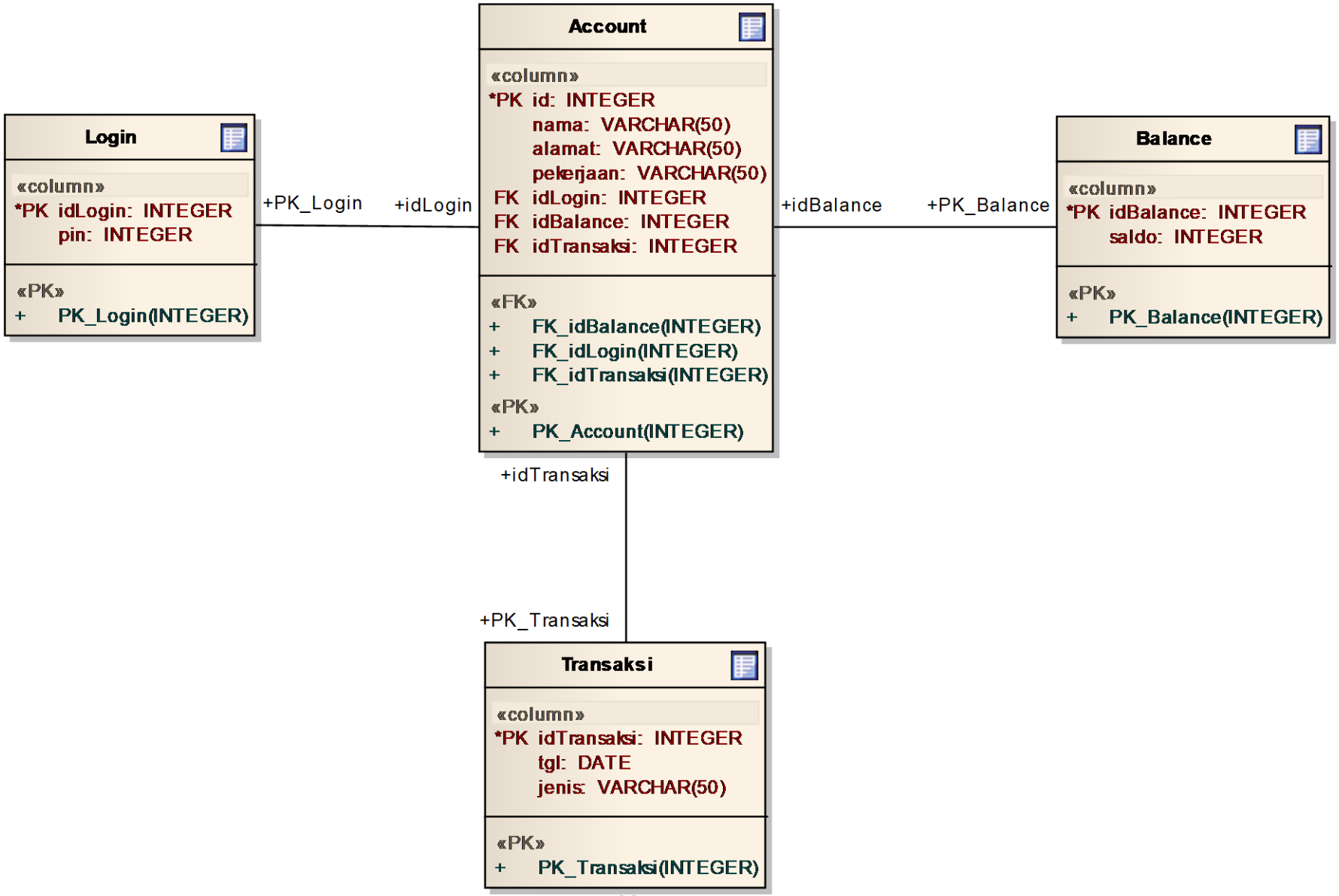
3.3 Perancangan Data Model

UML based Software Analysis and Design

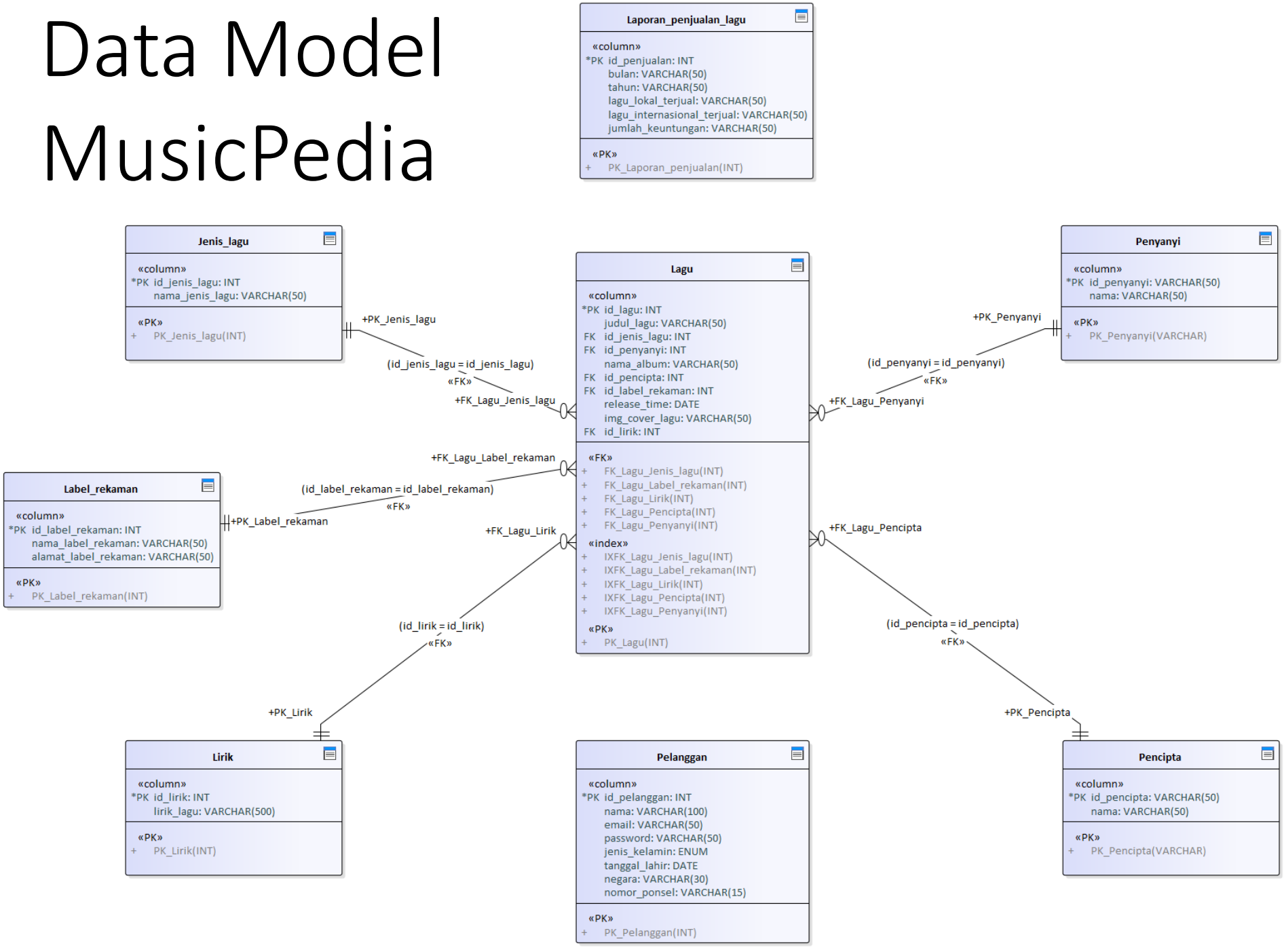
(Wahono, 2009)



Data Model Sistem ATM



Data Model MusicPedia



3.4 Perancangan Deployment Diagram

Deployment Diagram

- Servers
  - Mainframes, Minis, Micros
- Clients
  - Input/Output HW used by users
  - Terminals, PCs, special purpose HW
- Network
  - HW and SW to connect clients to servers
- Nodes
  - Any piece of hardware in the model
  - A computational resource
  - Labeled by its name
  - Stereotype to label the type of node

Node

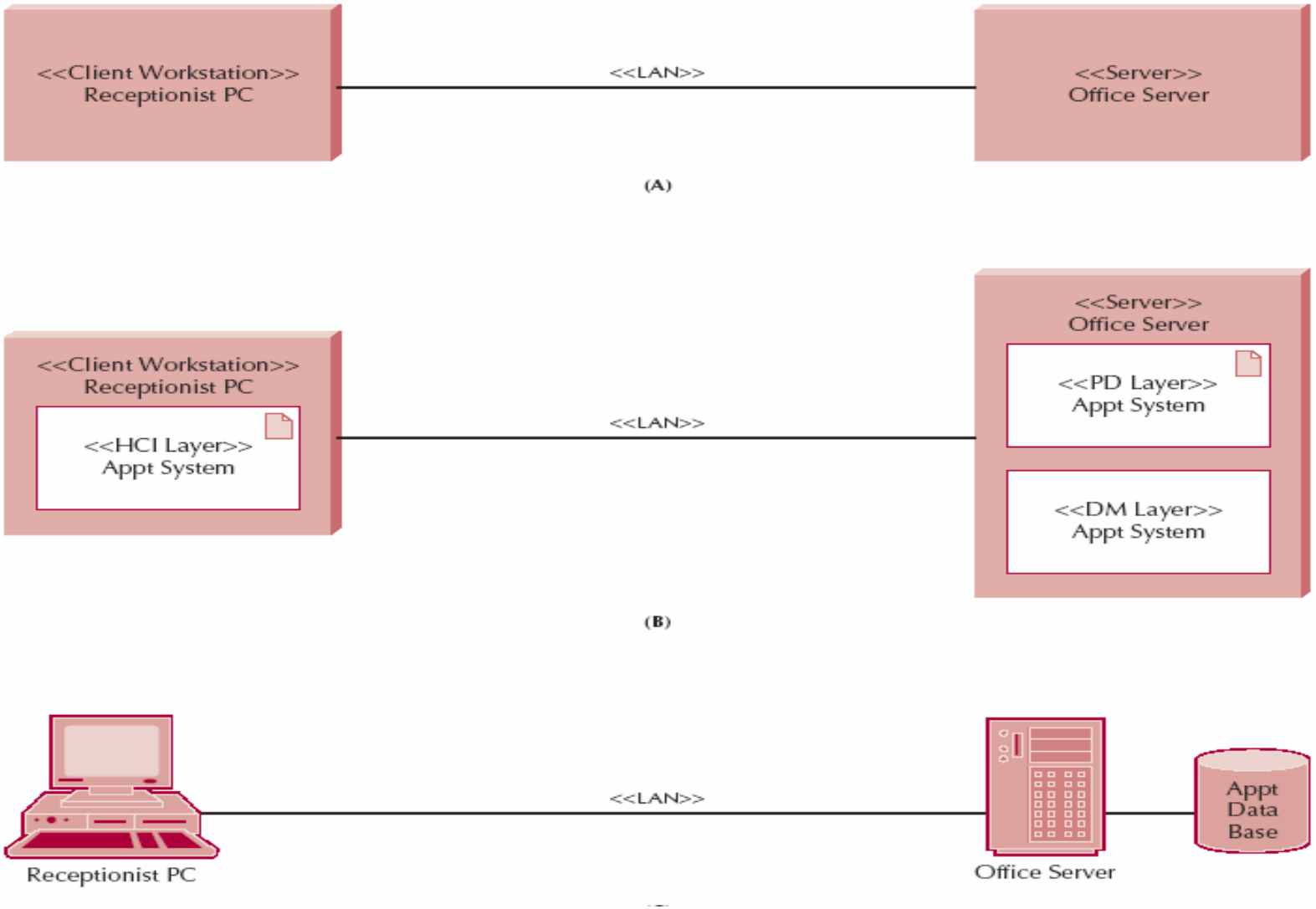
Artifact

Node with Deployment Artifact

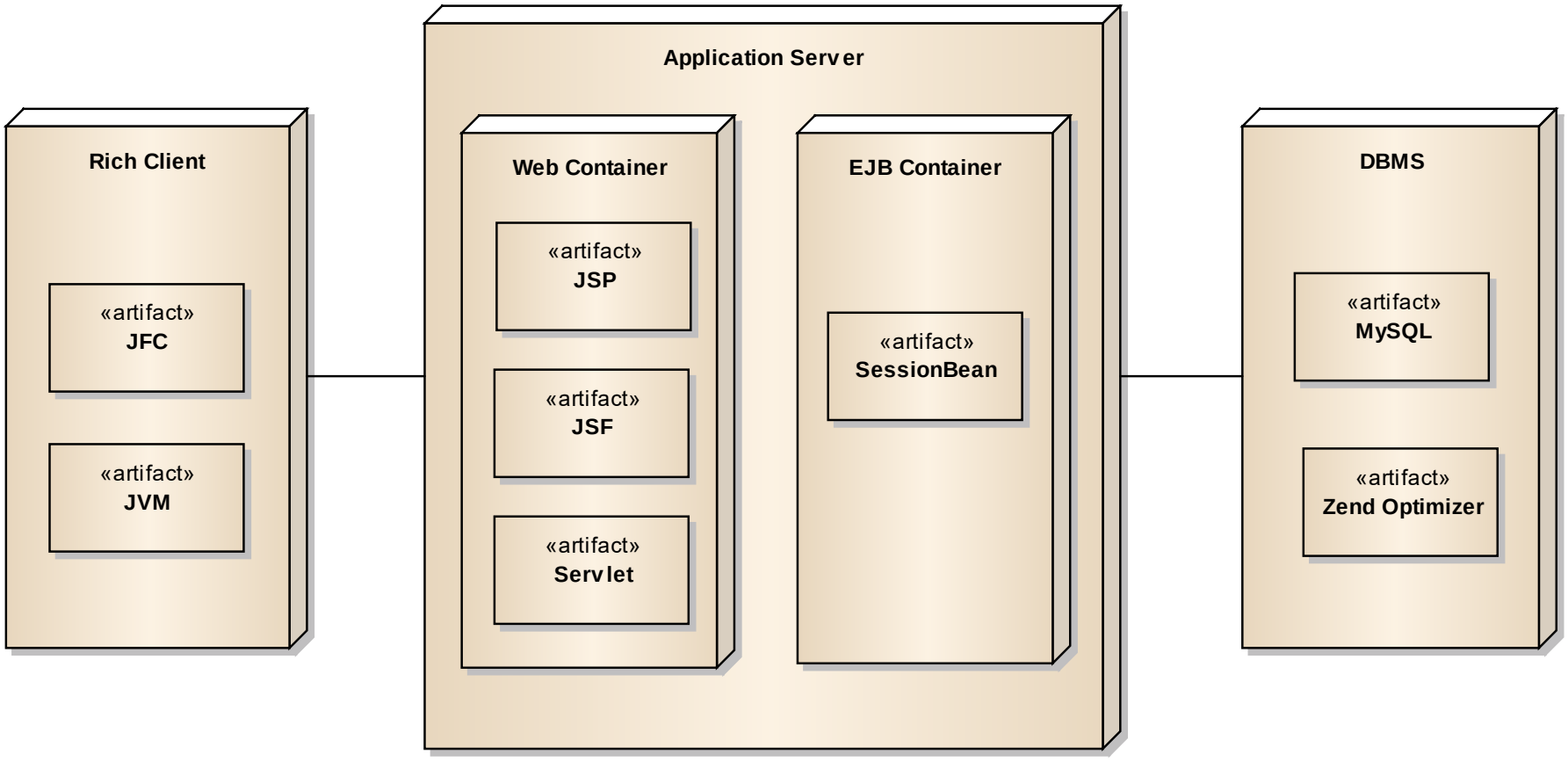
Communication Path

- Artifacts
  - Piece of the information system, such as software or a database table
- Node with Deployed Artifact
  - Shows artifact placed on a physical node
  - Good for showing distribution data or software
- Communication paths
  - Links between nodes of the network

Diagram Examples

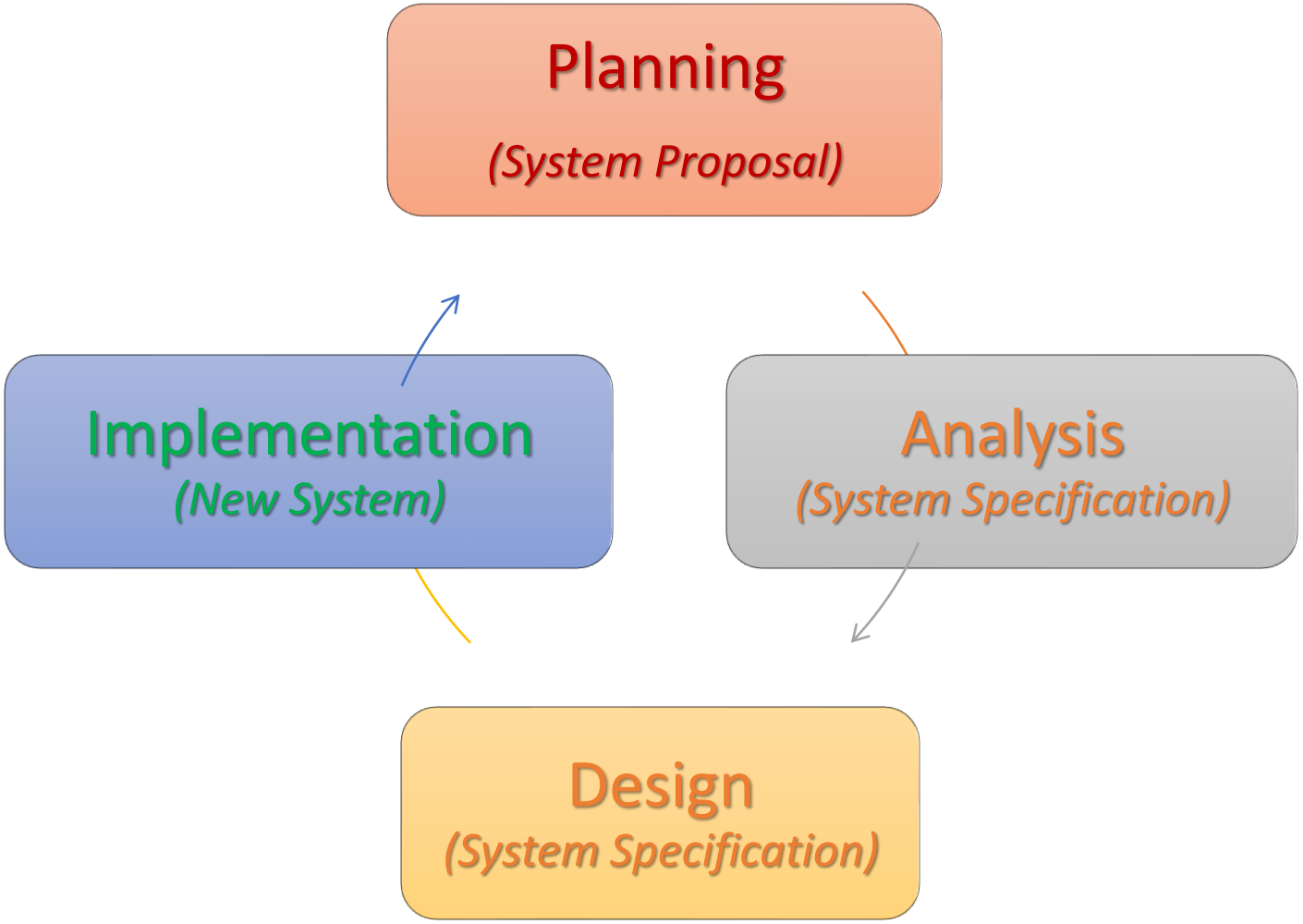


Deployment Diagram (3 Tier)



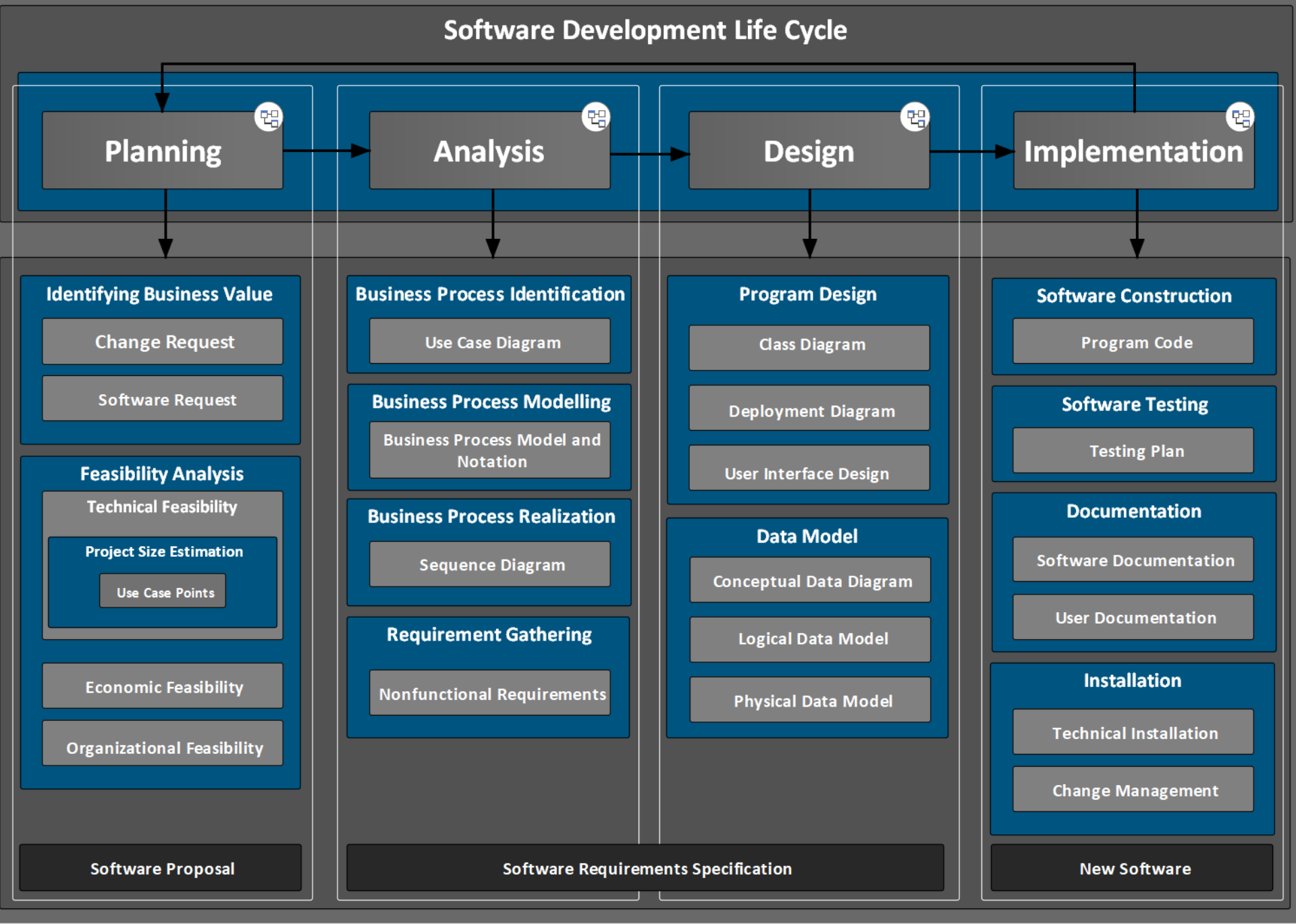
Rangkuman Studi Kasus Sistem ATM

Siklus Pengembangan Software

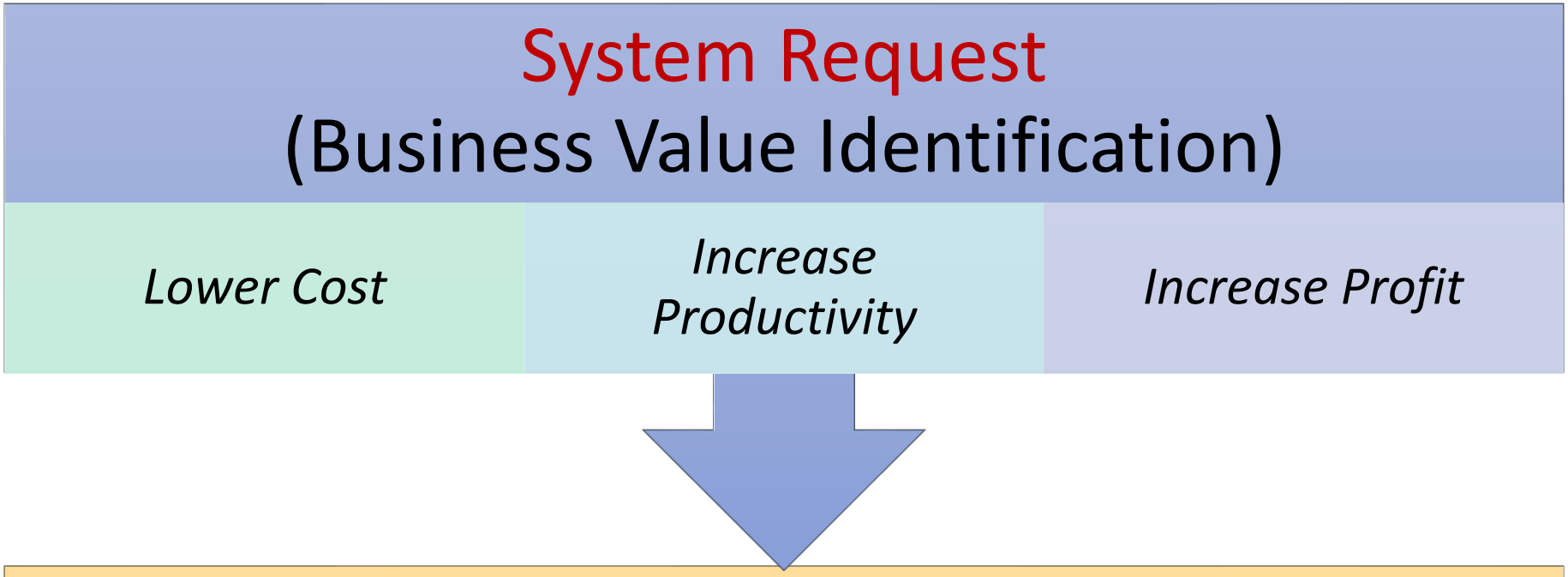


(Tilley, 2012) *(Dennis, 2016)* *(Valacich, 2017)*

Application Development Governance



Planning



System Request: Sistem Penjualan Musik Online

Project Sponsor:	Margaret Mooney, Vice President of Marketing
Business Needs:	Project ini dibangun untuk: 1. Mendapatkan pelanggan baru lewat Internet 2. Memberikan layanan pendukung dengan menggunakan internet

Business Requirements:

Sistem yang mendukung penjualan musik secara online. Fitur-fitur yang harus ada:

1. Fitur Pencarian Produk
2. Fitur Pencarian Toko yang Menyediakan Stok Produk
3. Fitur Pemesanan Produk Melalui Toko yang Menyediakan
4. Fitur Pembayaran dengan Berbagai Pilihan Pembayaran

Business Value:

Intangible Value:

- Meningkatkan kenyamanan dan kepuasan pelanggan
- Meningkatkan brand recognition tentang perusahaan di dunia Internet

Tangible Value:

1. Meningkatkan penjualan dari pelanggan baru lewat Internet:
   - Rp 400 juta peningkatan penjualan dari pelanggan baru dan Rp 600 juta dari pelanggan lama
2. Mengurangi biaya operasional untuk menangani komplain dari pelanggan
   - Rp 100 juta pengurangan tahunan biaya telepon untuk menangani pelanggan

Studi Kelayakan Sistem Penjualan Musik Online

Margaret Mooney dan Alec Adams membuat studi kelayakan untuk pengembangan Sistem Penjualan Musik Online

Kelayakan Teknis

Sistem penjualan musik online layak secara teknis, meskipun memiliki beberapa risiko.

Risiko Berhubungan dengan **Kefamilieran dengan Aplikasi**: Resiko Tinggi

- Divisi Marketing tidak memiliki pengalaman menggunakan sistem penjualan online
- Divisi IT memiliki pemahaman yang baik tentang sistem penjualan offline, akan tetapi tidak berpengalaman mengembangkan sistem penjualan musik online

Risiko Berhubungan dengan **Kefamilieran dengan Teknologi**: Resiko Sedang

- Divisi IT tidak menguasai masalah infrastruktur dan ISP, tetapi akan menyewa konsultan
- Divisi IT cukup familier dengan framework dan IDE yang akan digunakan
- Divisi Marketing tidak memiliki pengalaman menggunakan teknologi Web

Risiko berhubungan dengan **Ukuran Project**: Risiko Rendah

- Perusahaan memiliki total 30 orang pengembang
- Project dikerjakan oleh 5 orang pengembang dengan estimasi waktu 6 bulan

Kompatibilitas dengan sistem dan infrastruktur yang ada: Risiko Rendah

- Sistem pemesanan yang ada sekarang menggunakan *open standard*, jadi sangat kompatibel dengan sistem penjualan berbasis web yang akan dibangun

Kelayakan Ekonomi

Cost benefit analysis telah dilakukan. Sistem Penjualan musik online memiliki peluang yang baik untuk bisa meningkatkan pendapatan perusahaan.

- Return on Investment (ROI) setelah 3 tahun: **31%**
- Break-even point (BEP): **2.25 tahun**
- Total keuntungan setelah 3 tahun: **Rp. 503.559.986,-**

Keuntungan Intangible

- Meningkatkan kepuasaan pelanggan
- Meningkatkan branding perusahaan

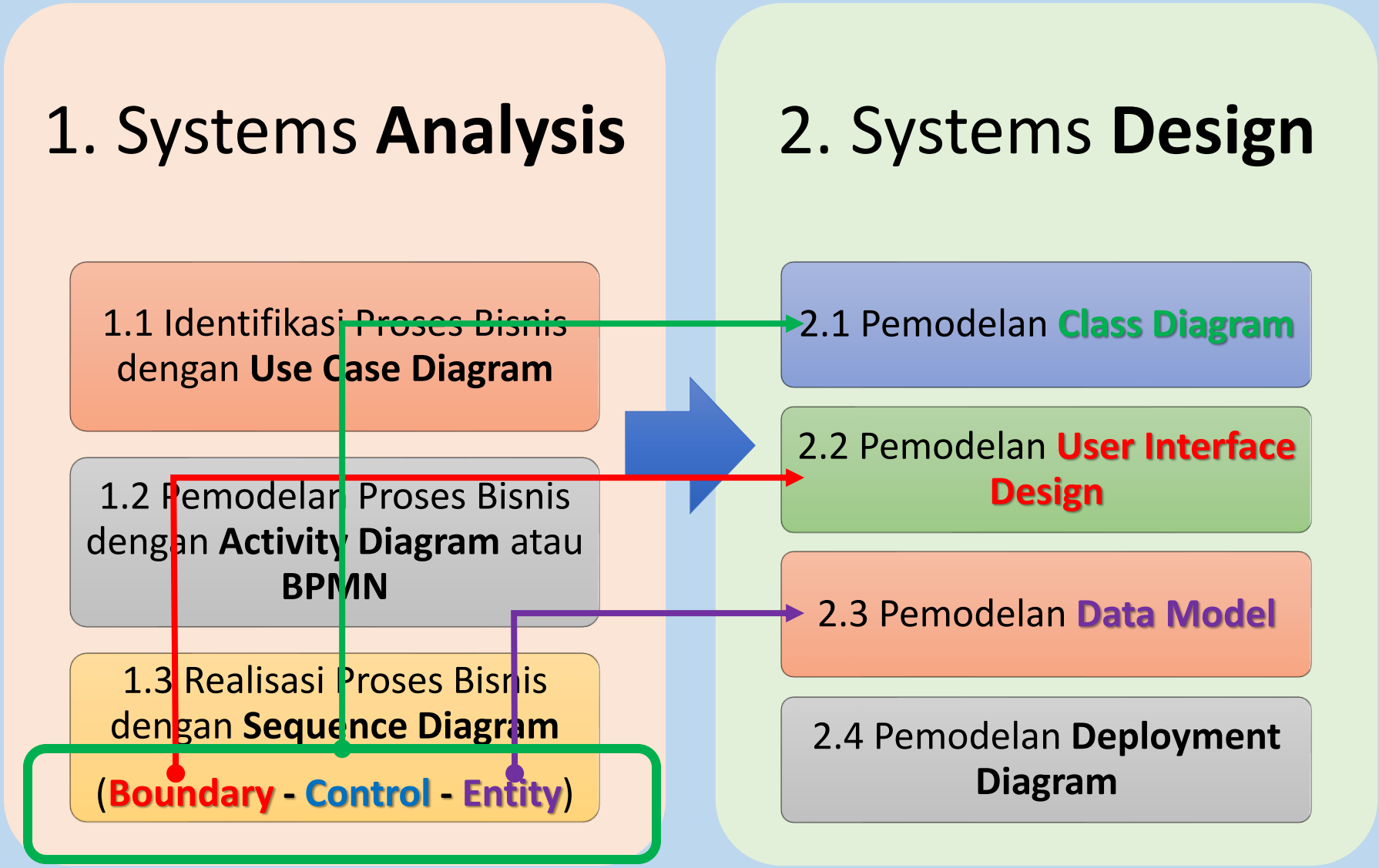
Kelayakan Organisasi

- Secara organisasi, resikonya rendah. Tujuan dari pengembangan sistem penjualan musik online adalah meningkatkan penjualan perusahaan. Dan ini selaras dengan KPI marketing yang ke arah peningkatan kuantitas penjualan
- Project champion dari pengembangan sistem penjualan musik online ini adalah Margaret Mooney, Vice President of Marketing

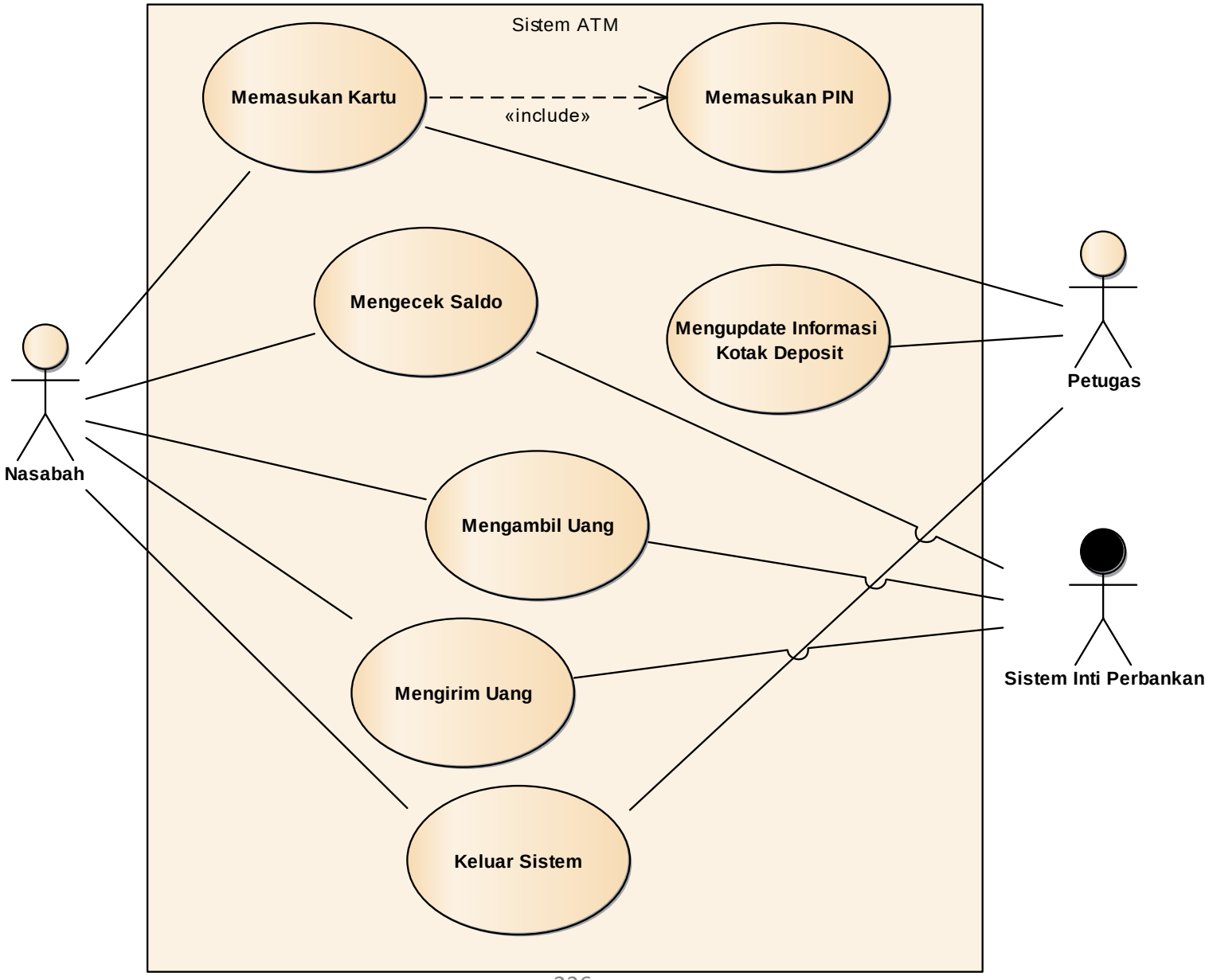
	2019	2020	2021
Peningkatan penjualan dari pelanggan baru	0	400,000,000	500,000,000
Peningkatan penjualan dari pelanggan lama	0	600,000,000	700,000,000
Pengurangan biaya operasional dan telepon	0	100,000,000	100,000,000
Total Benefits:	**0**	**1,100,000,000**	**1,300,000,000**
PV of Benefits:	**0**	**978,996,084**	**1,091,505,068**
PV of All Benefits:	**0**	**978,996,084**	**2,070,501,152**
Honor Tim (Analysis, Design and Implementation)	360,000,000	0	0
Honor Konsultan	90,000,000	0	0
Total Development Costs:	**450,000,000**	**0**	**0**
Honor Pengelola Web	60,000,000	70,000,000	80,000,000
Biaya Lisensi Software	50,000,000	60,000,000	70,000,000
Hardware upgrades	100,000,000	100,000,000	100,000,000
Biaya Komunikasi	20,000,000	30,000,000	40,000,000
Biaya Marketing	100,000,000	200,000,000	300,000,000
Total Operational Costs:	**330,000,000**	**460,000,000**	**590,000,000**
Total Costs:	**780,000,000**	**460,000,000**	**590,000,000**
PV of Costs:	**735,849,057**	**409,398,362**	**495,375,377**
PV of all Costs:	**735,849,057**	**1,145,247,419**	**1,640,622,796**
Total Project Costs Less Benefits:	**-780,000,000**	**640,000,000**	**710,000,000**
Yearly NPV:	**-735,849,057**	**569,597,722**	**669,811,321**
Cumulative NPV:	**-735,849,057**	**-166,251,335**	**503,559,986**
Return on Investment (ROI) di Tahun 3: 30.70%	**-100.00%**	**-0.145166304**	**0.306932213**
Break-even Point (BEP): 2.25 tahun	234		**2.248206218**

UML based Software Analysis and Design

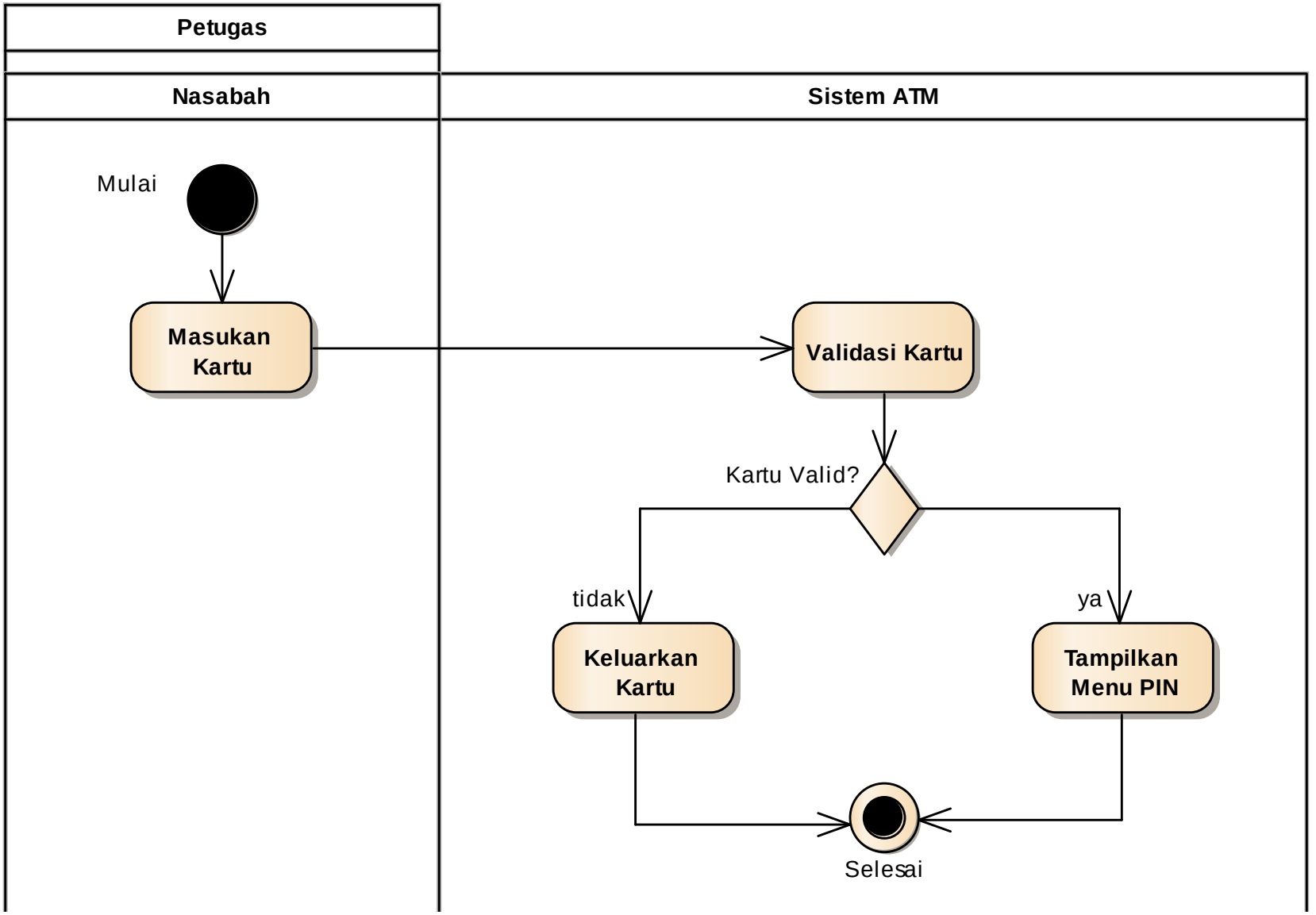
(Wahono, 2009)



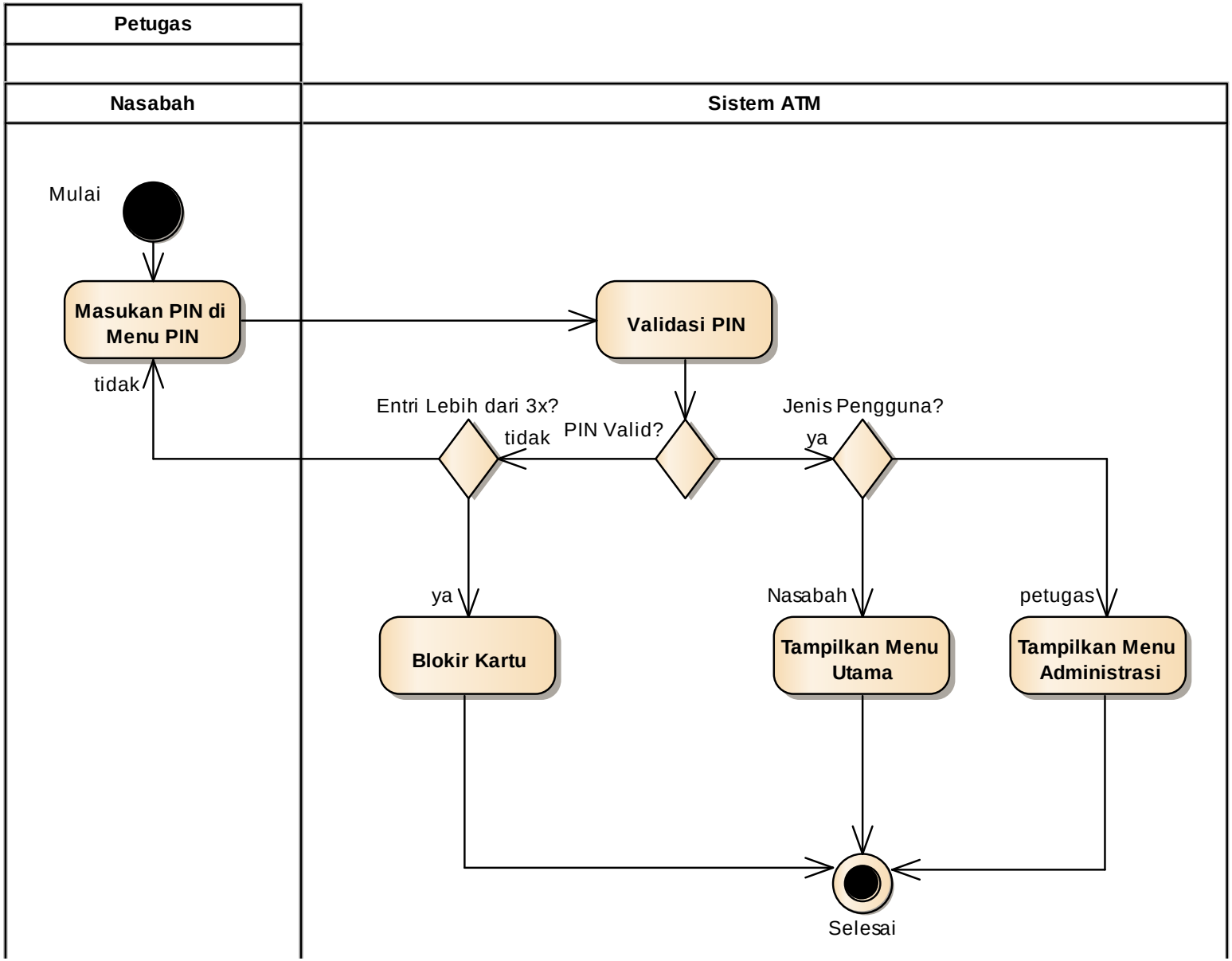
Use Case Diagram



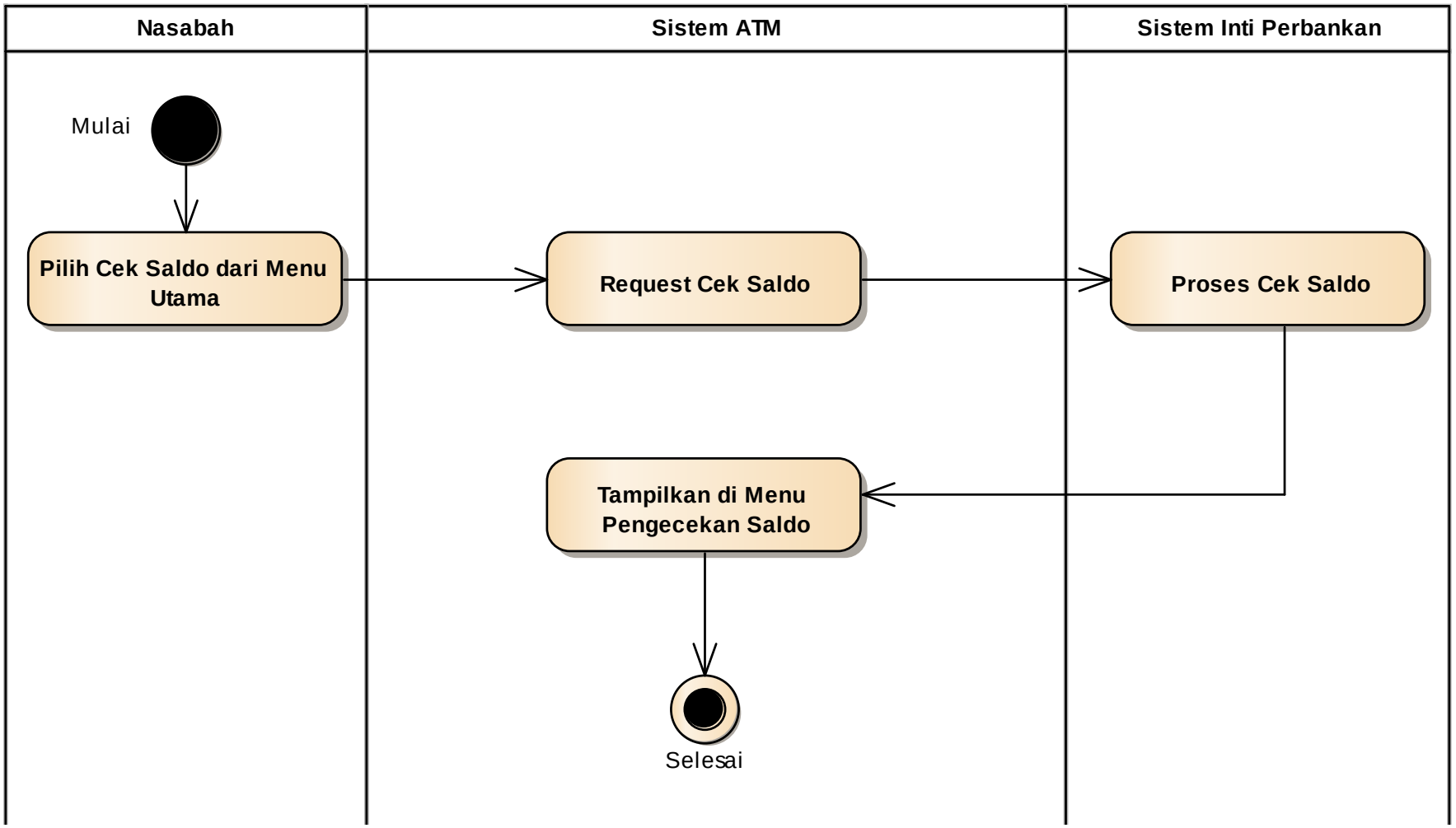
Activity Diagram: Memasukkan Kartu



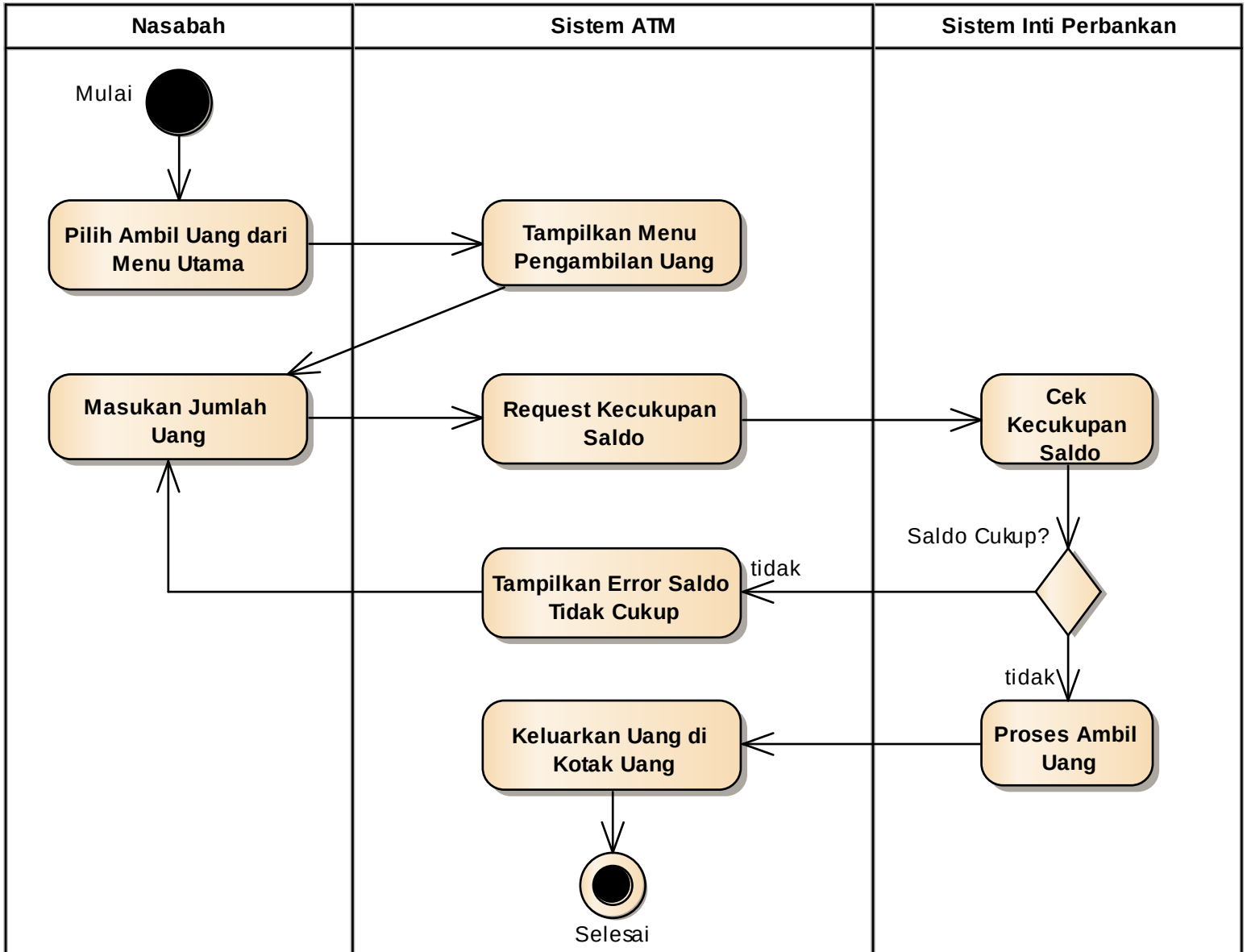
Activity Diagram: Memasukkan PIN



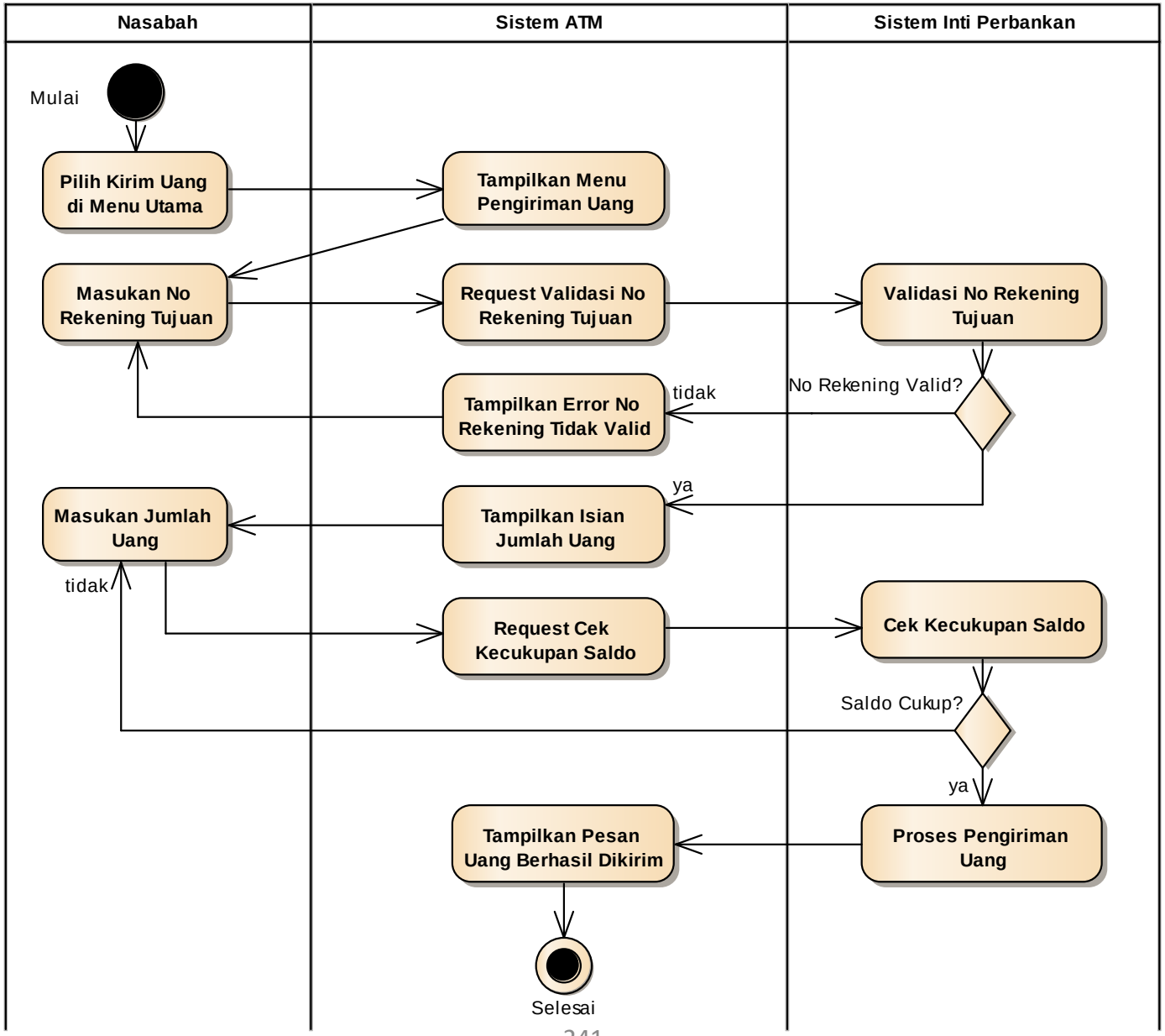
Activity Diagram: Mengecek Saldo



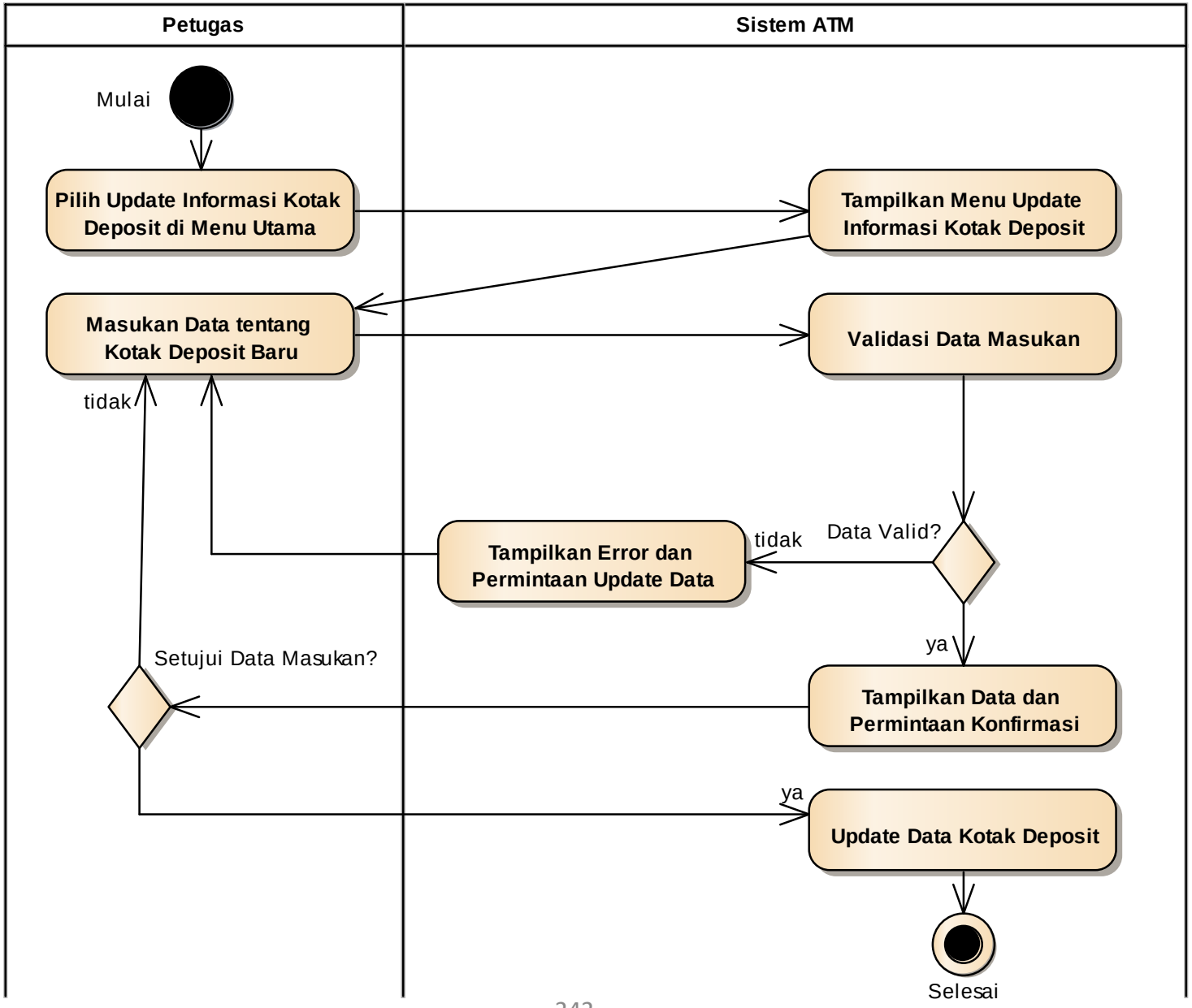
Activity Diagram: Mengambil Uang



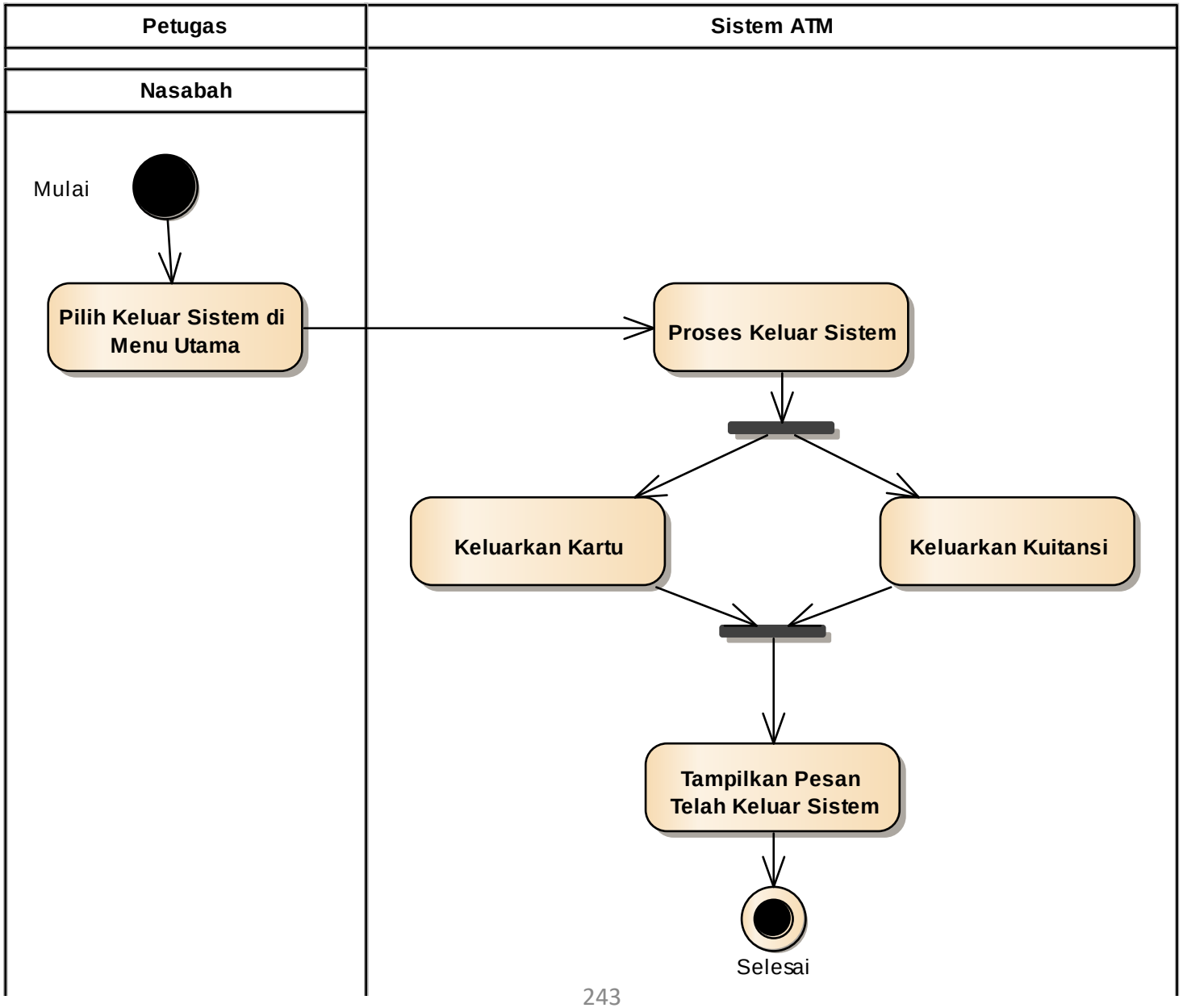
Activity Diagram: Mengirim Uang



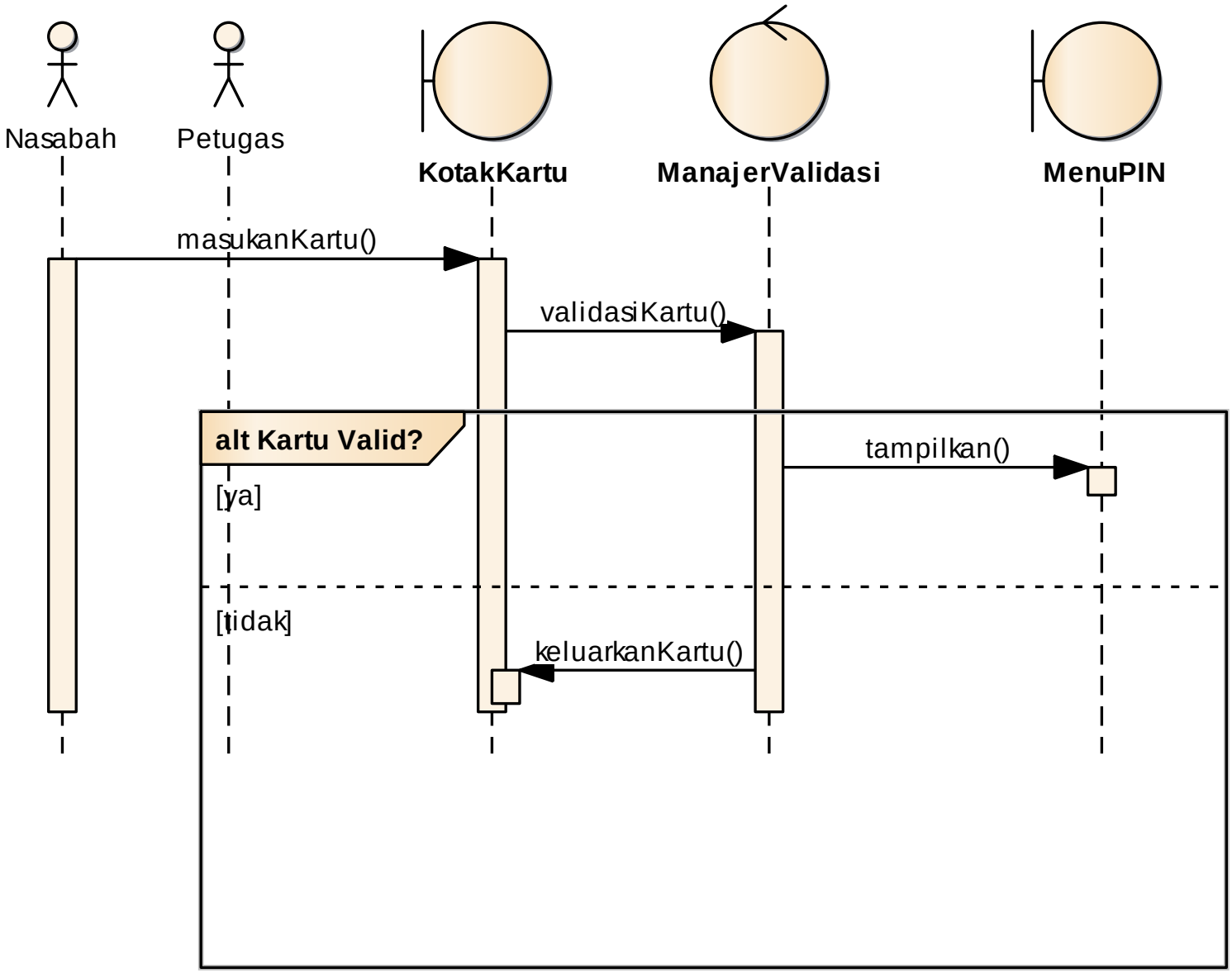
Activity Diagram: Mengupdate Informasi Kotak Deposit



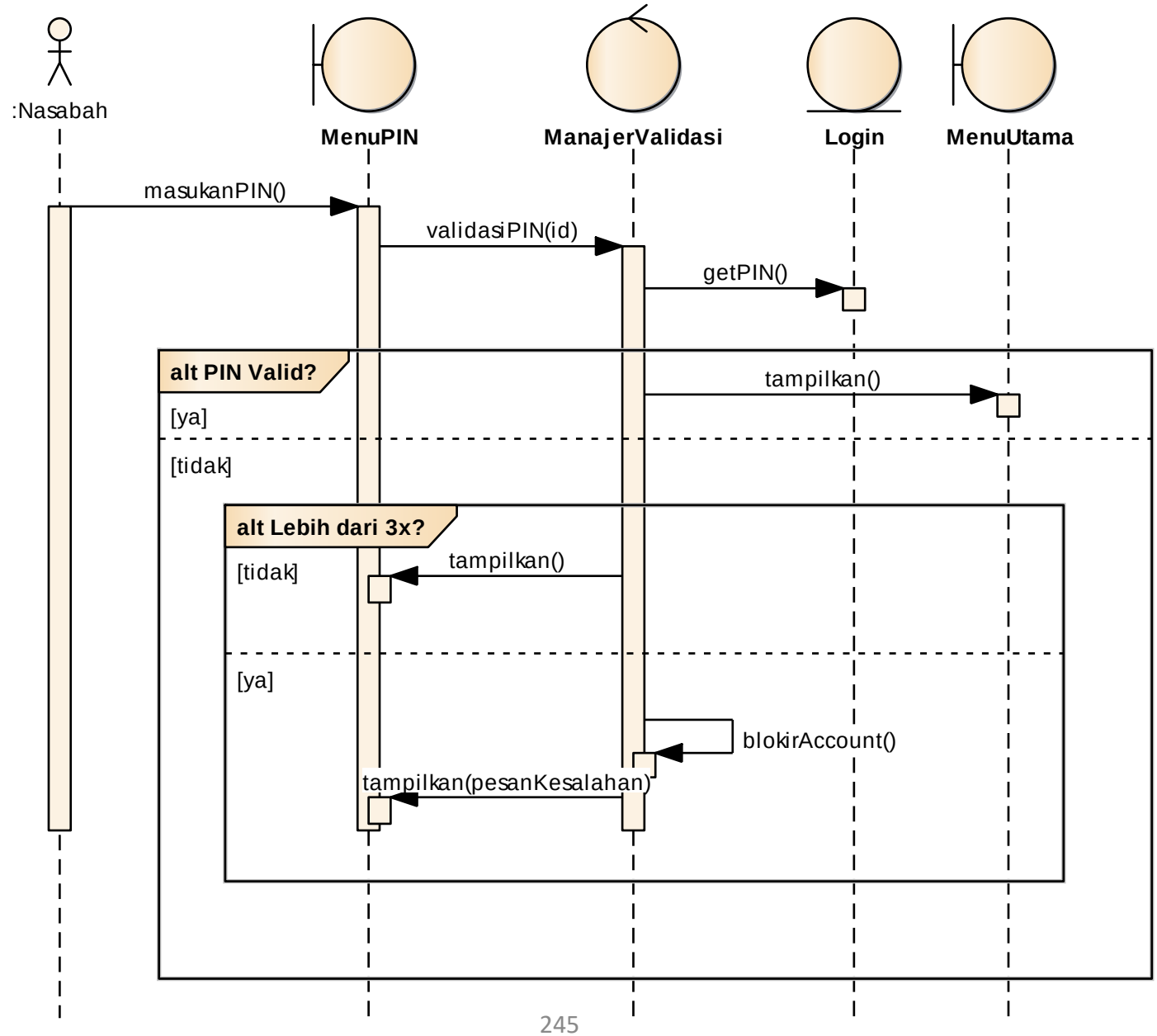
Activity Diagram: Keluar Sistem



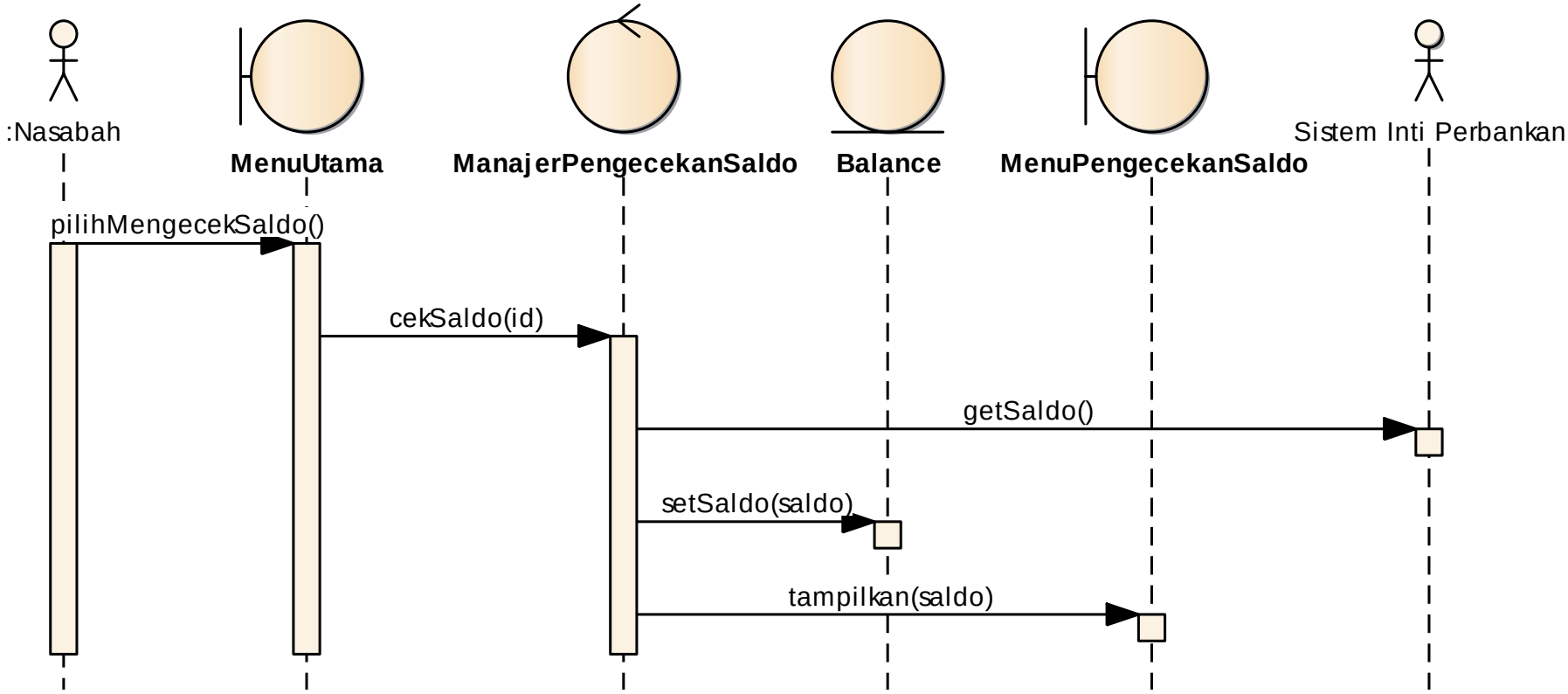
Sequence Diagram: Memasukkan Kartu



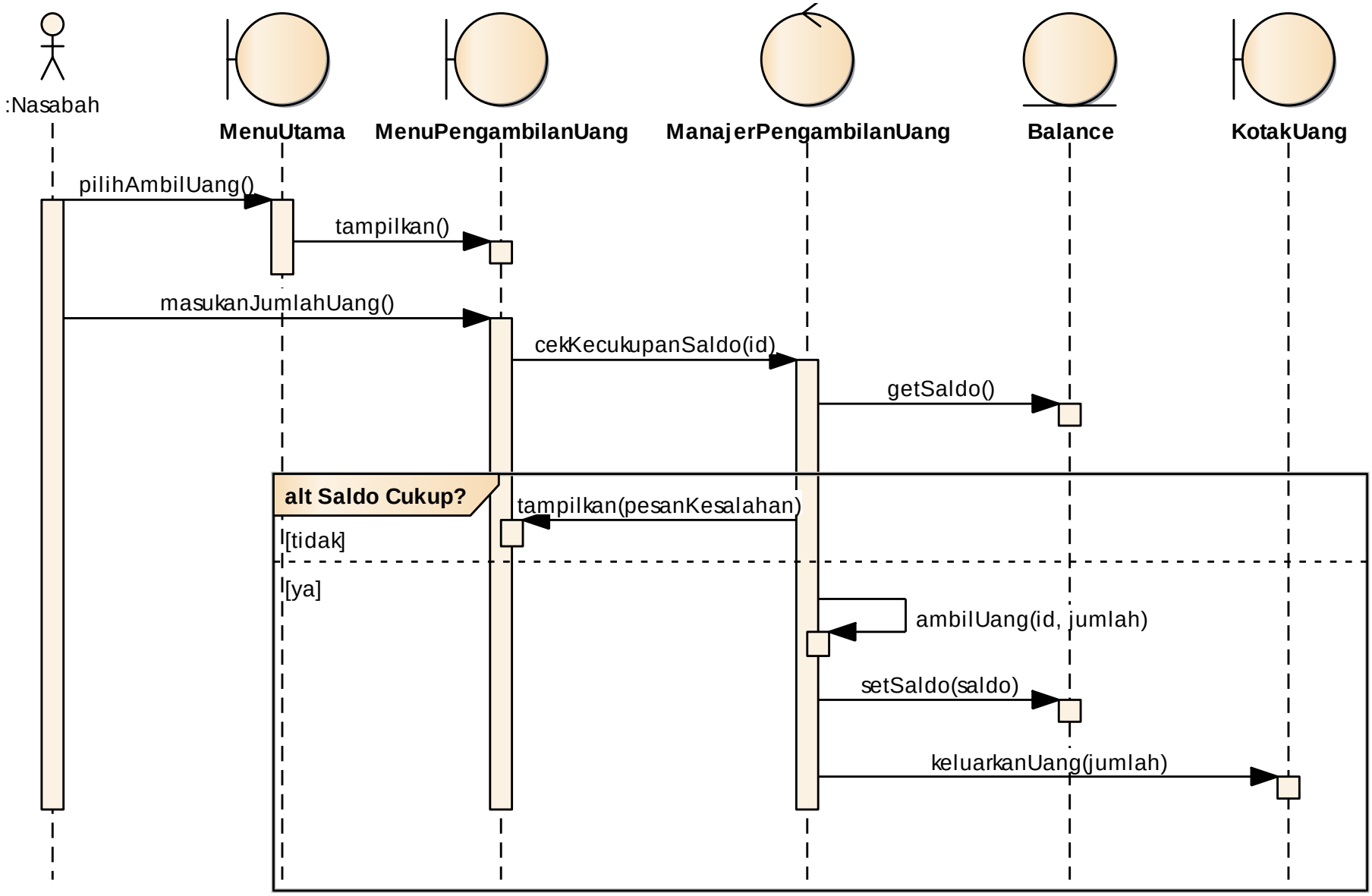
Sequence Diagram: Memasukkan PIN



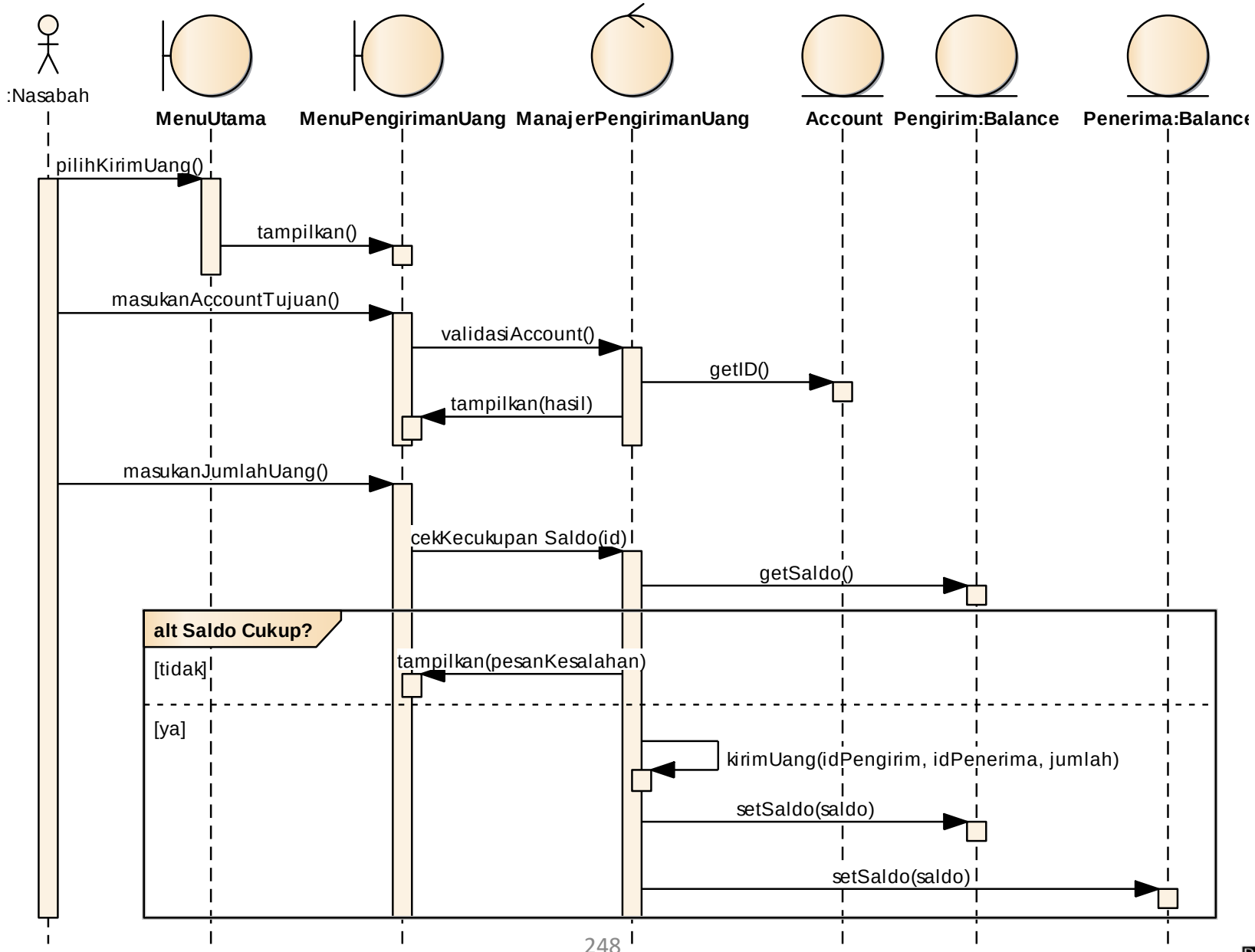
Sequence Diagram: Mengecek Saldo



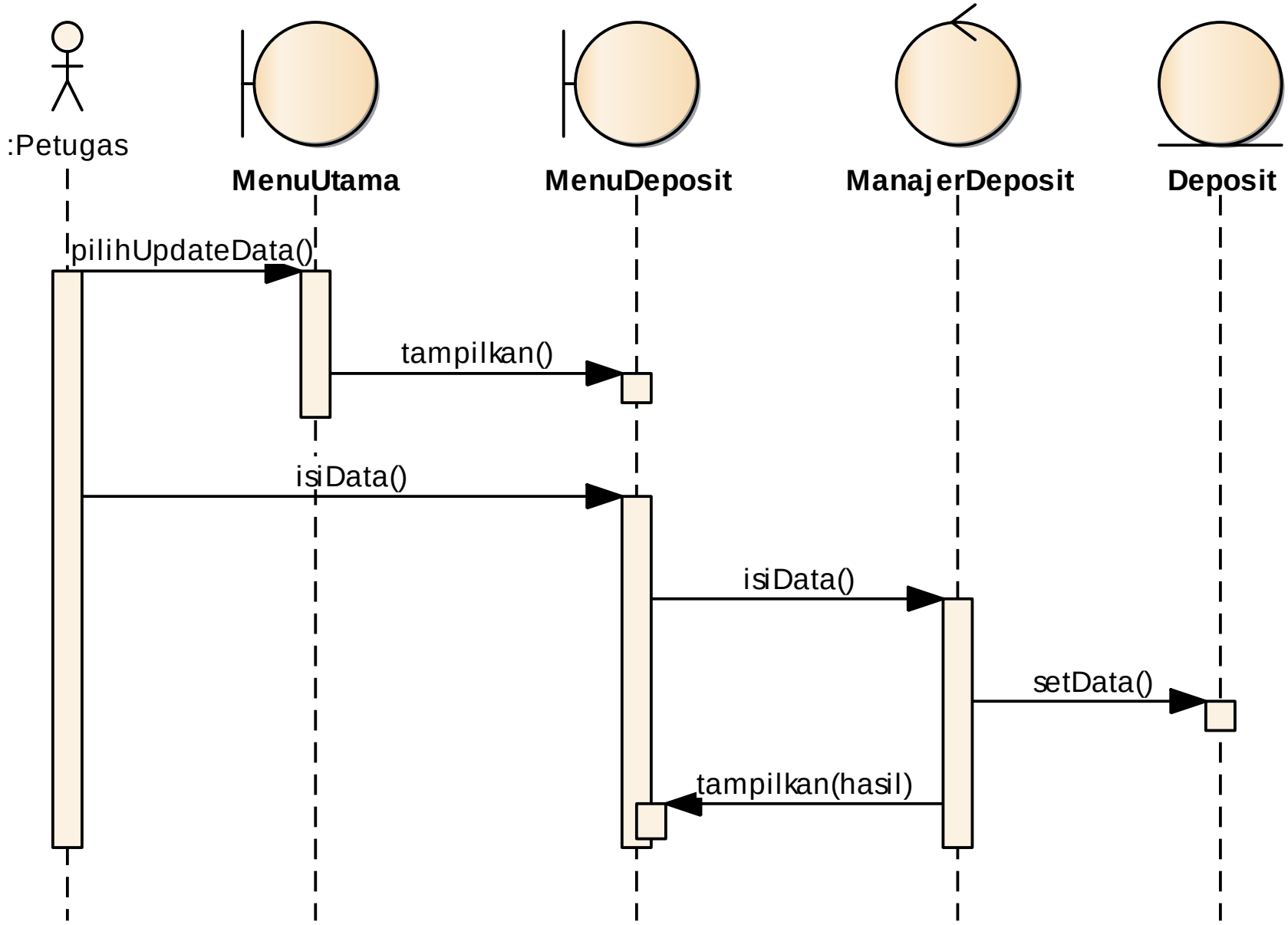
Sequence Diagram: Mengambil Uang



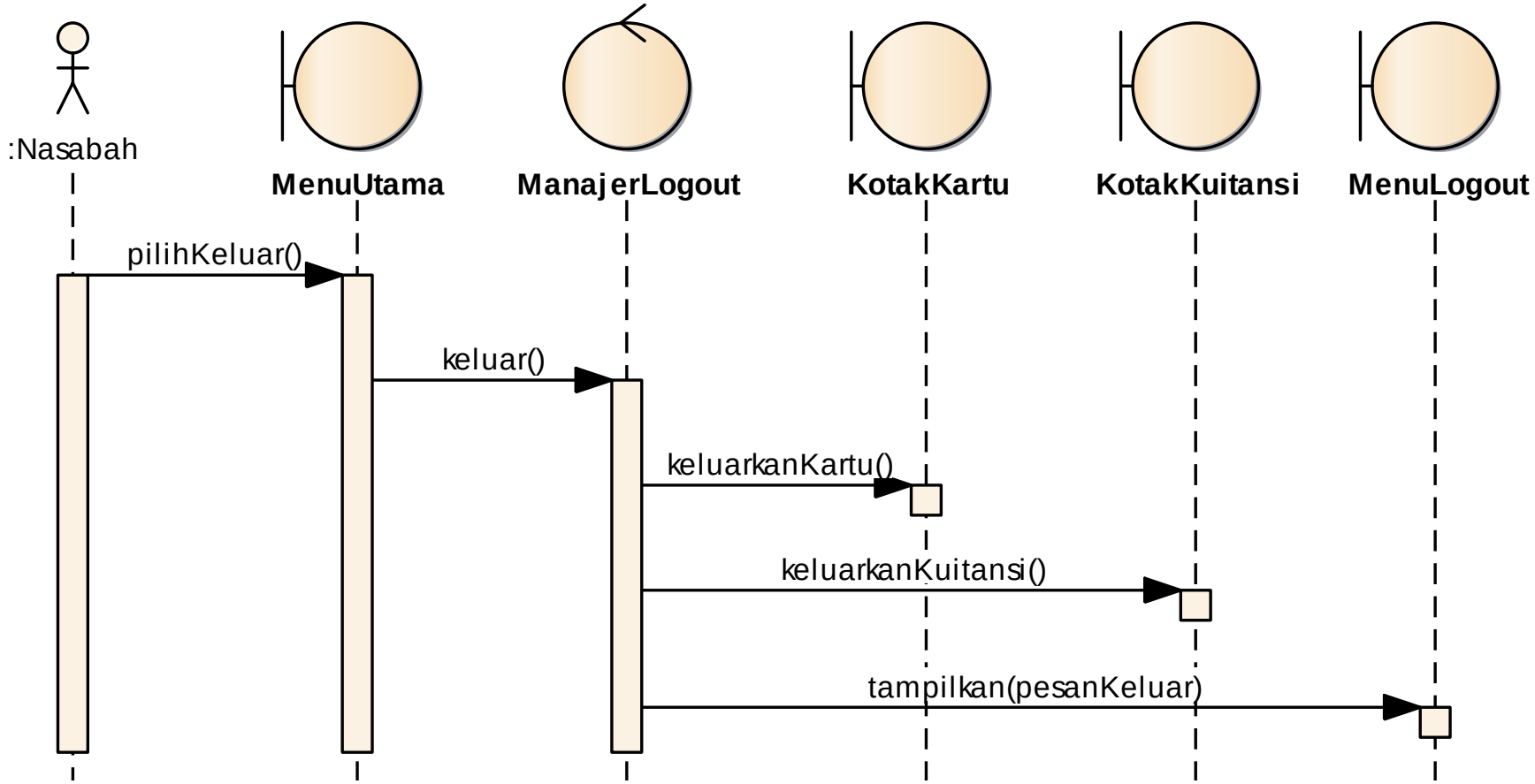
Sequence Diagram: Mengirim Uang



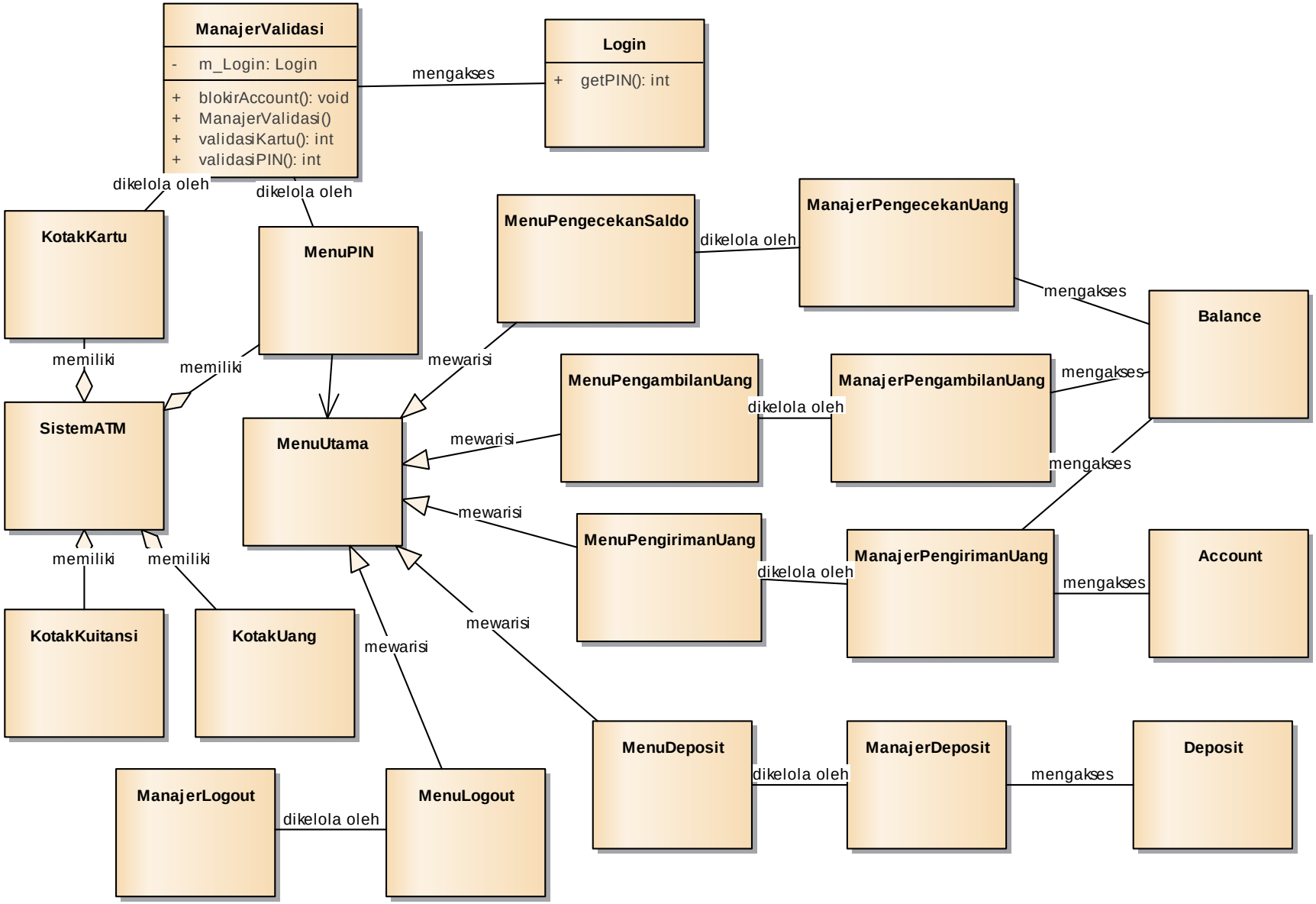
Sequence Diagram: Mengupdate Informasi Kotak Deposit



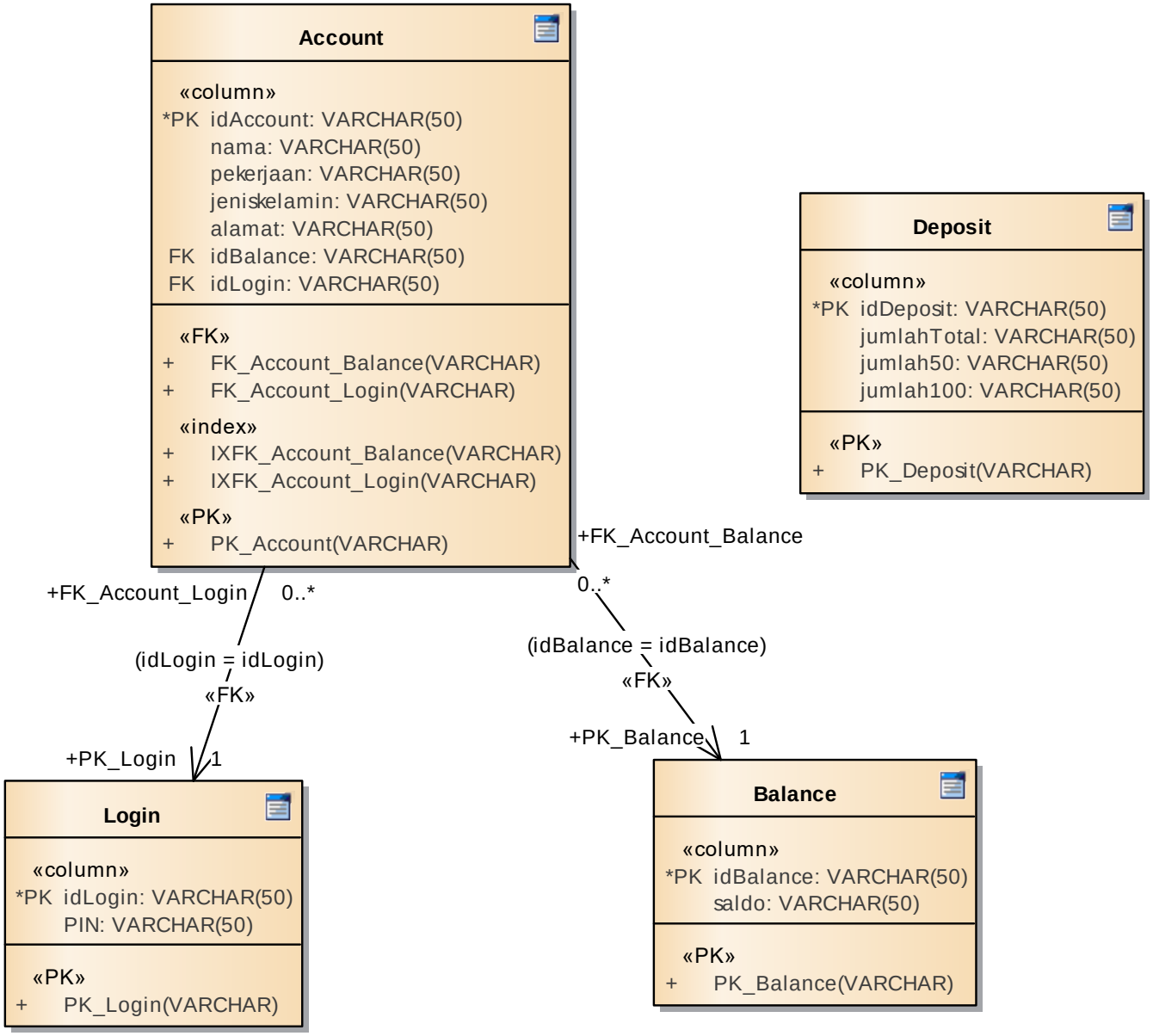
Sequence Diagram: Keluar Sistem



Class Diagram

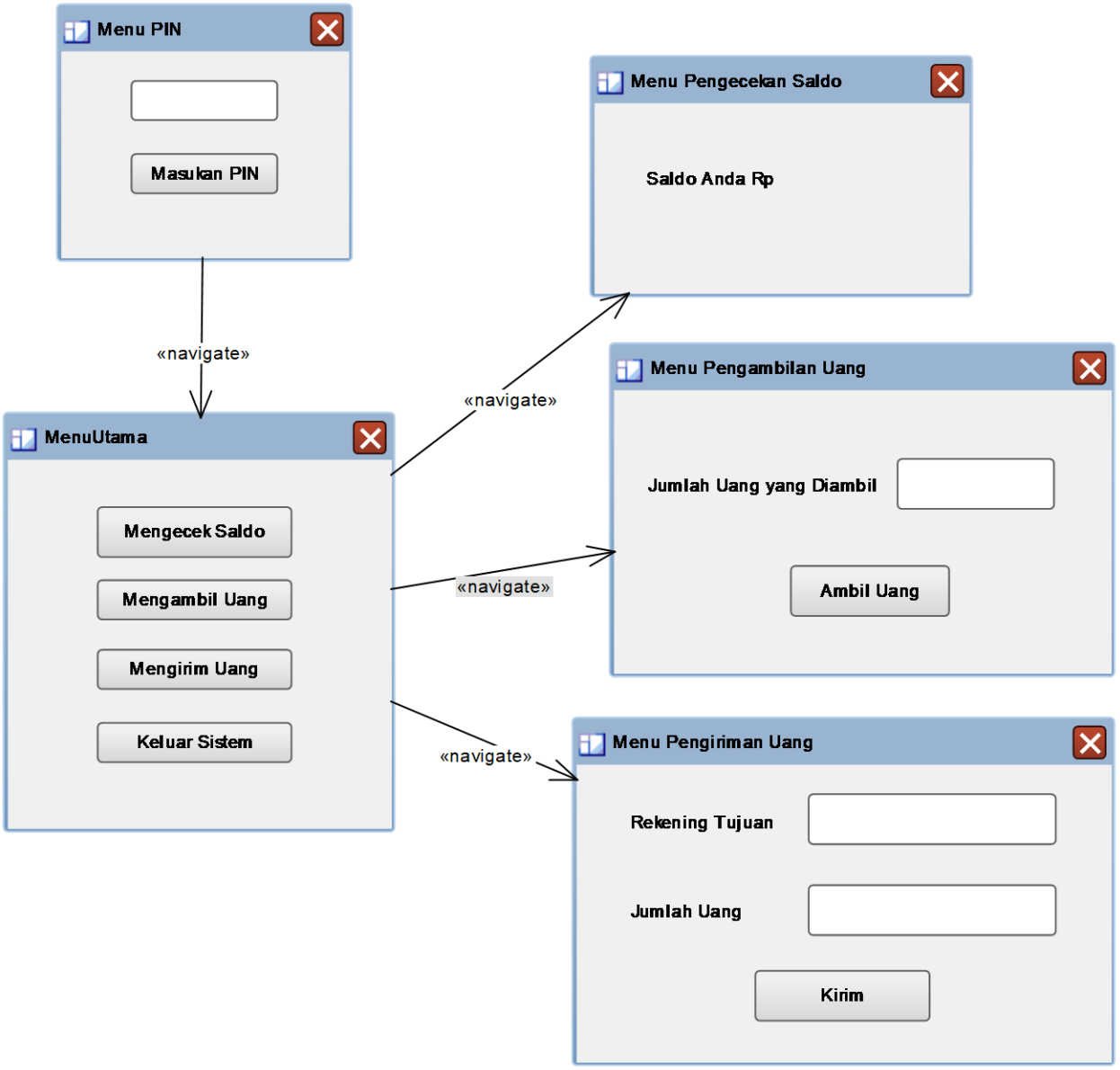


Data Model

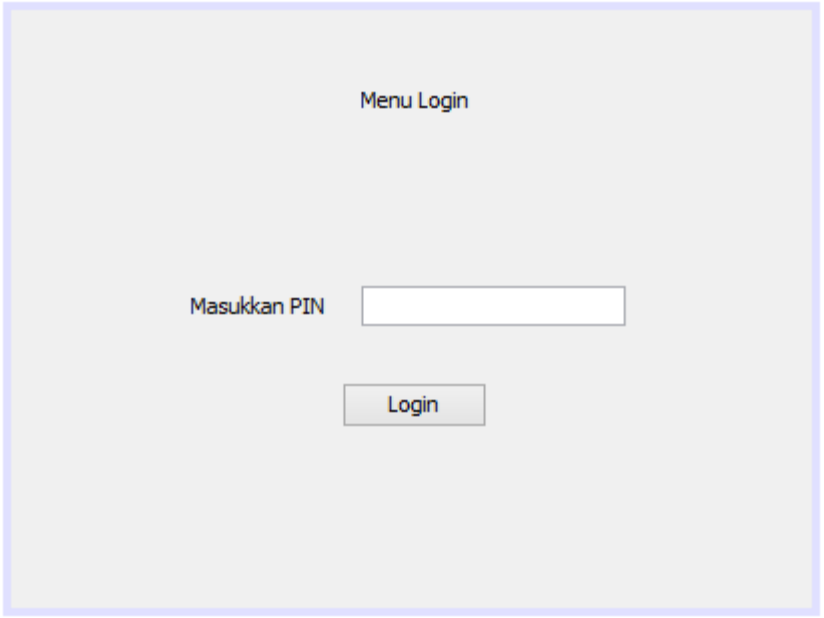


User Interface Design

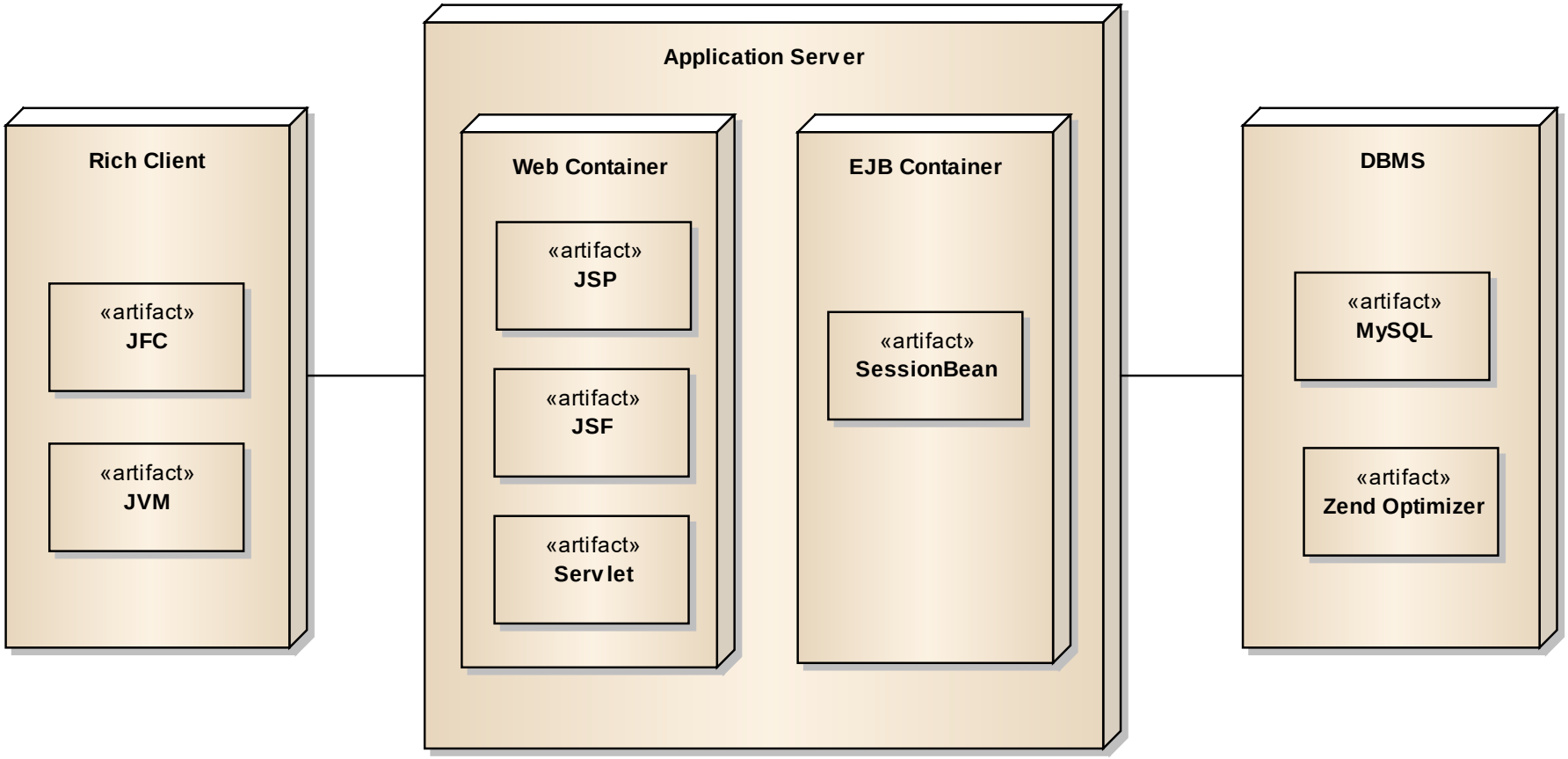
User Interface Design (Sparx EA)



User Interface Design (Netbeans)



Deployment Diagram (3 Tier)



Contoh Template System Specification (SRS, BRD, FSD)

1. System Planning
   - 1.1 Project Scope
   - 1.2 Project Schedule
   - 1.3 Project Team
2. System Design
   - 2.1 Functional Requirements
     - 2.1.1 Actor
     - 2.1.2 Use Case Diagram
     - 2.1.3 Activity Diagram (BPMN)
     - 2.1.4 Sequence Diagram
     - 2.1.5 Class Diagram
     - 2.1.6 Data Model
     - 2.1.7 User Interface Design
     - 2.1.8 Deployment Diagram
     - 2.1.9 Relational Matrices
       - 2.1.9.1 Actor – Activity Diagram
       - 2.1.9.2 Actor – Sequence Diagram
   - 2.2 Nonfunctional Requirements
     - 2.2.1 Operational
     - 2.2.2 Performance
     - 2.2.3 Security
     - 2.2.4 Hardware
     - 2.2.5 Development Platform
     - 2.2.6 Deadline
3. System Implementation
   - 3.1 Testing Strategy
   - 3.2 Installation Strategy
   - 3.3 Change Management Strategy

Terima Kasih

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