Informacioni sistemi

Računske vežbe:

URN i UML projektovanje

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User Requirements Notation (URN)

- **URN**
  - Goal-Oriented Requirements Language (GRL)
  - Use Case Maps (UCM)
  - Kombinovanje UCM i GRL pomaže u povezivanju tekstualnih zahteva i dizajna sistema.

Centralna uloga ciljeva u inženjeringu zahteva

- **Definisanje ciljeva obezbedjuje prirodni mehanizam za struktuiranje kompleksnih specifikacija na različitim nivoima važnosti.**
- **Ciljevi obezbeđuju razloge za zahteve.**
- **Ciljevi vode identifikaciji zahteva**
- **Ciljevi obezbeđuju bogatiju strukturu za zadovoljenje argumenata**
- **Ciljevi pružaju osnovu za prikazivanje usklađenosti sistema sa strateškim ciljevima organizacije.**
- **Ciljevi obezbeđuju precizne kriterijume za potpunost i relevantnost zahteva.**

Centralna uloga ciljeva u inženjeringu zahteva

- **Ciljevi pružaju dobru osnovu za analizu rizika.**
- **Ciljevi mogu da posluže za upravljanje konfliktima među zahtjevima.**
- **Ciljevi pružaju kriterijum za ograničavanje obima sistema.**
- **Ciljevi podržavaju analizu zavisnosti među agentima.**
- **Ciljevi pružaju osnovu za razmišljanje o alternativnim opcijama. • Ciljevi podržavaju upravljanje praćenja.**
- **Ciljevi pružaju osnovne informacije za evoluciju sistema.**

GRL: Zašto GRL?

- Povezuje zahteve na poslovne ciljeve
- Omogućuje razmatranje funkcionalnih zahteva
- Zahtevi sistema se sistematično izvode iz ciljeva
- Razmatranjem alternativnih ciljeva obezbeđeno je i alternativno istraživanje predloga samog sistema
- Formalilizacija cilja obezbeđuje poboljšanjima da se pokažu korektnim i kompletnim.

GRL: Zašto GRL?

- Ciljevi su važan drajver za elaboraciju zahteva, a posebno ako uzmemo u obzir da su ciljevi složenih sistema uglavnom veoma kompleksni i vrlo često konfliktni.
- GRL podržava argumentaciju, pregovaranje, detekciju konflikta sistema i donošenje odluka
- GRL identifikuje alternativne zahteve i alternativne granice nekog sistema
- GRL obezbeđuje jasno praćenje od strategijskih ciljeva do tehničkih zahteva
- GRL dozvoljava ponovnu upotrebu stabilnih ciljeva visokog nivoa kada se sistem dalje razvija i raste

GRL

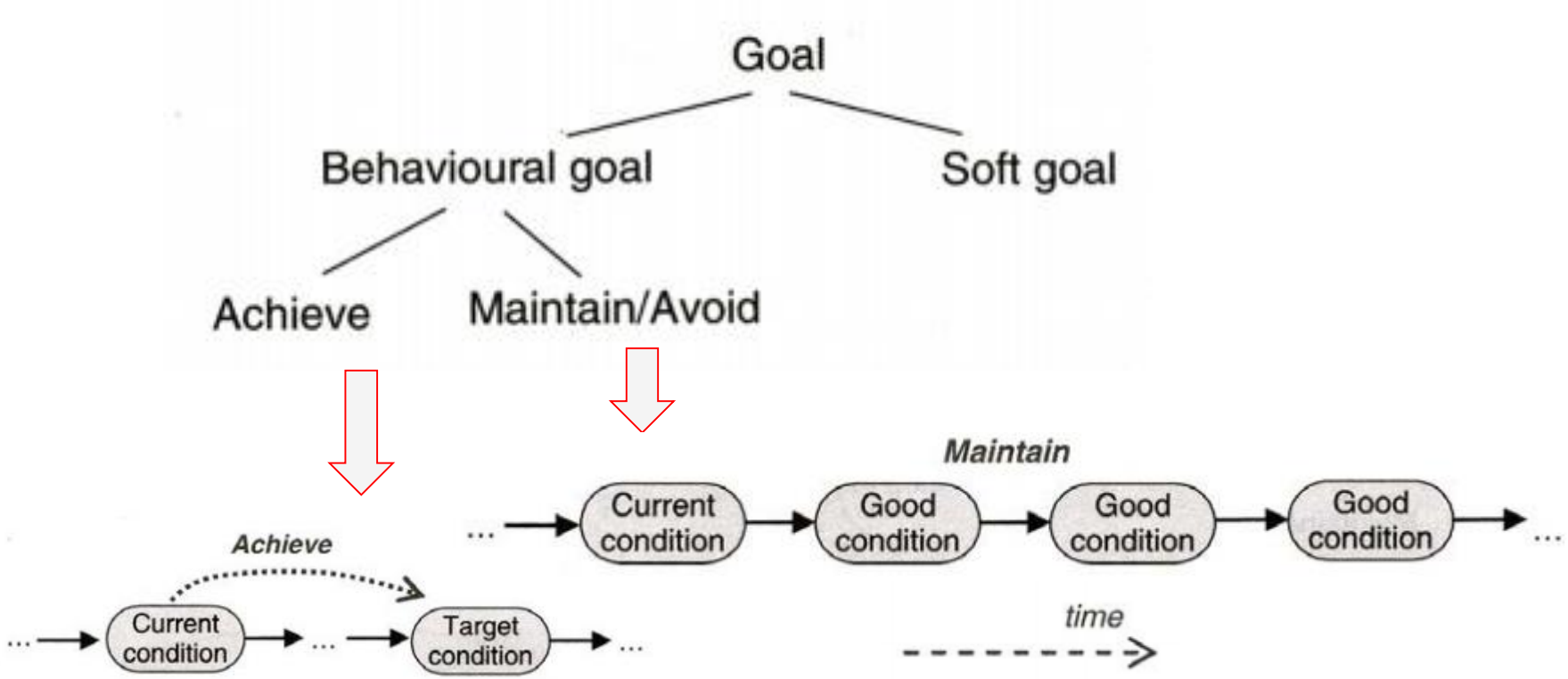
- **GRL se koristi za:**
  - Vizuelni opis poslovnih ciljeva, prioriteta, alternativnih rešenja i odluka.
  - Dekompoziciju ciljeva visokog nivoa na alternativna rešenja koja predstavljaju zadatke (ovakav proces se zove operacionalizacija)
  - Modeluje pozitivne i negativne uticaje ciljeva i zadataka jedan na drugi.
  - Identifikuje zavisnosti između učesnika
  - Vrši se rezonovanje alternativa sistema

Cilj i zahtev

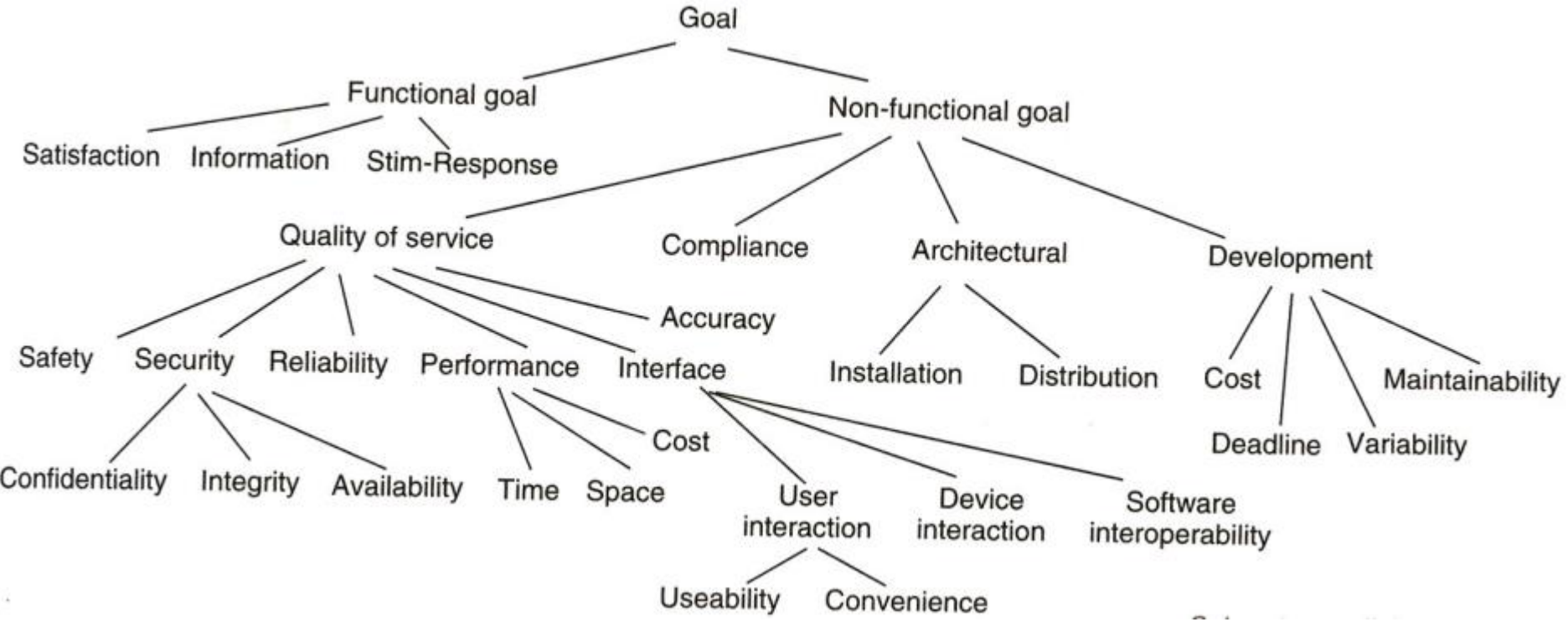
- ***Cilj (engl. goal)***
  - je iskaz, koji opisuje neku situaciju za koju je poželjno da bude tačna, i koji sistem treba da zadovolji kroz kooperaciju njegovih agenata.
- ***Zahtev (engl. requirement)***
  - je cilj pod odgovornošću jednog agenta

Cilj

- **Taksonomija cilja**

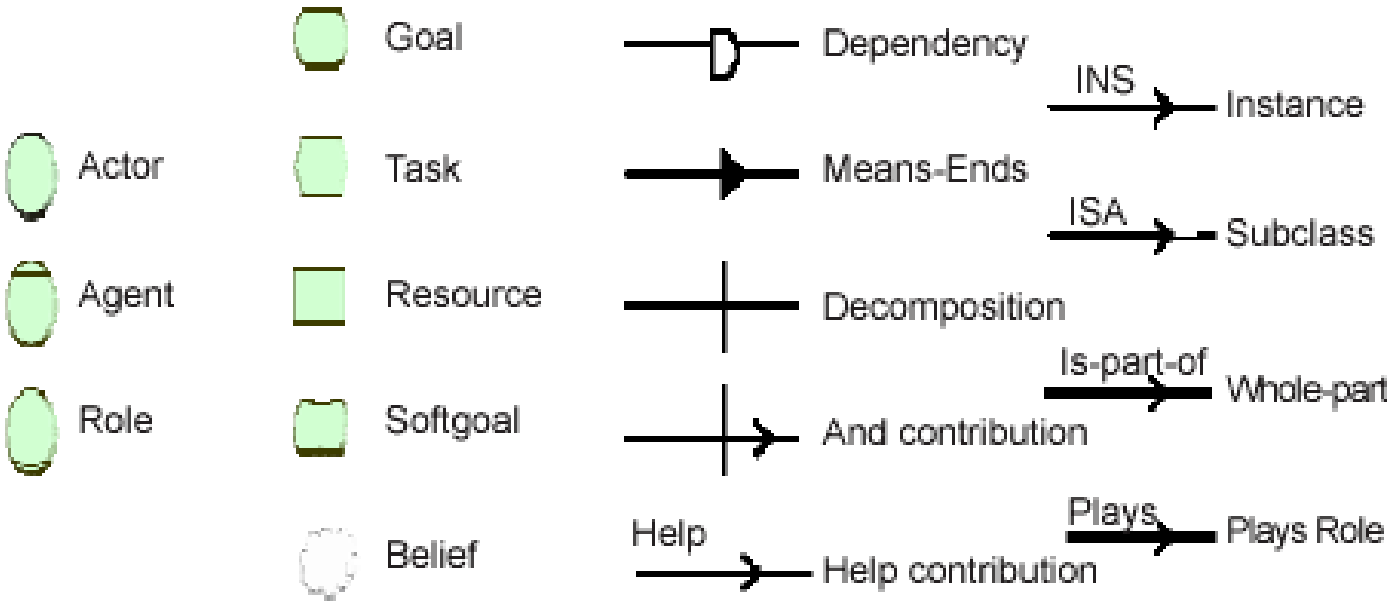


Podela ciljeva -- zahteva



GRL

- **GRL je grafička notacija koja obezbeđuje rasuđivanje o nefunkcionalnim zahtevima.**



GRL koncepti

- **Cilj, Meki cilj, doprinosi ili veze koji uključuju AND i OR veze**
  - Napomena: Dostignuće mekog cilja se ne može meriti i kvalitativnog su karaktera, i u vezi su sa nefunkcionalnim zahtevima, dok ciljevi su funkcionalni i kvantitativnog su karaktera
- **Učesnik (actor) –**
  - podtip agenta

GRL koncepti

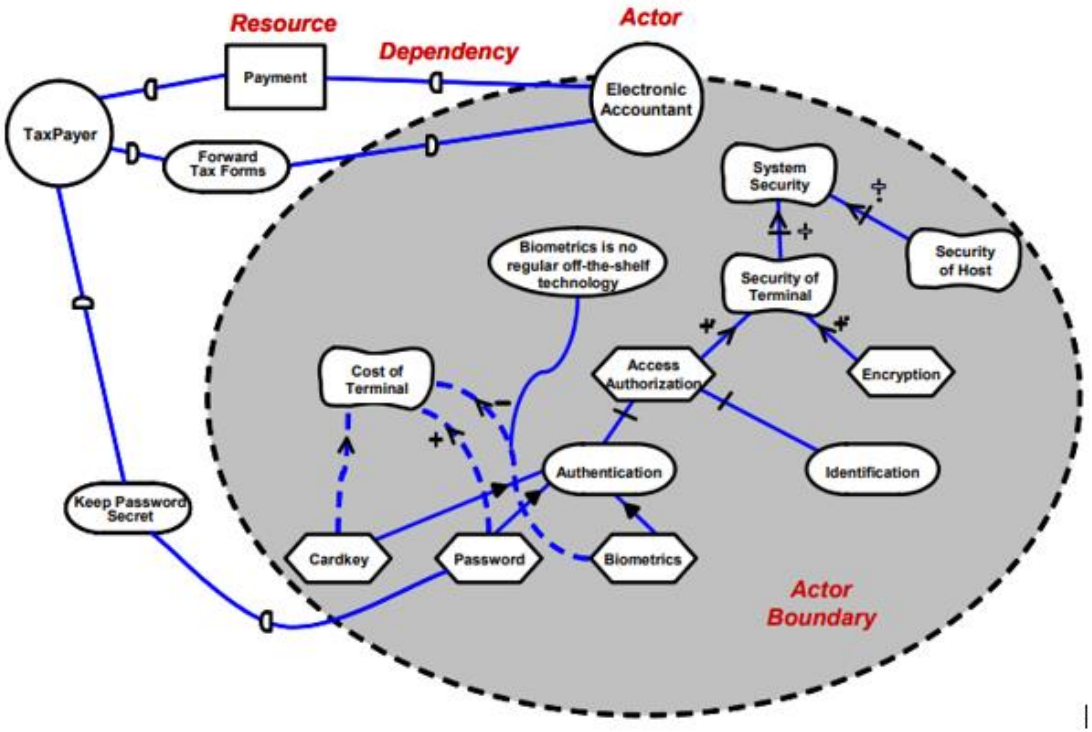
- **Zadatak (task)**
  - Predloženo rešenje koje dostiže neki cilj ili zadovoljava meki cilj
- **Zavisnost (dependency)**
  - Jedan učesnik zavisi od drugog učesnika npr. Prodavac zavisi od online kupca za plaćanje
- **Resurs (resource)**
  - Koristi se u zavisnosti kao ono od čega se zavisi

GRL notacija

- **Doprinos ili korelacione veze**
  - Doprinos (contribution) opisuje željeni uticaj
  - Postoje kvantitativni i kvalitativni doprinosi
    - **kvalitativni:**

GRL notacija

GRL grafik moze da se dodeljuje korisnicima tj. Aktorima u sistemu

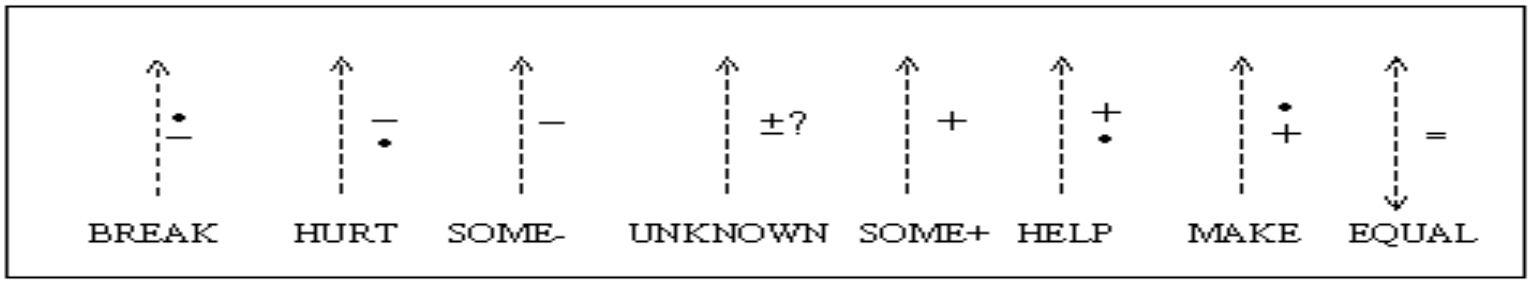


Zavisnosti (dependencies) se definišu između aktora zajedno sa resursima i drugim elementima

Faculty of Electronic Engineering

Veze doprinosa (Contribution Relationship)

Korelacione veze (Correlation Relationship)



Ciljevi i Meki ciljevi u GRL-u

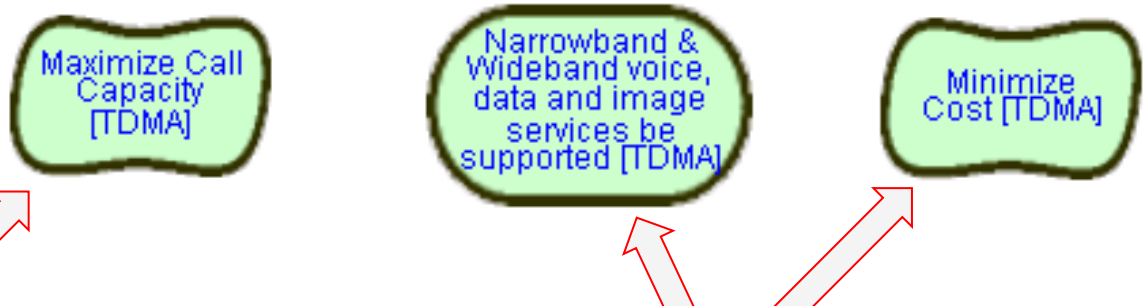
- **Primer Mekih ciljeva i njihova upotreba za odabir između alternativa: Razmatranje potrebe za ATM terminalom (terminal za autentikaciju)**

Question: Alternative Authentication Mechanisms?
References: Service: Authenticate (this is a Goal)

	Criteria 1: ATM Unit Cost	**Criteria 2:** Privacy
Option 1: Account number	+	–
Option 2: Fingerprint reader	–	+
Option 3: Smart Card + PIN	+	+

Criteria 1 and 2 are SoftGoals

Ciljevi i Meki ciljevi u GRL-u



SOFTGOAL MaximizeCallCapacity **OF** TDMA*

ATTRIBUTE

Rates : “At least two times current capacity”

HOLDER IncomingCallServiceProvider

SOFTGOAL MinimizeCost **OF TDMA**

ATTRIBUTE

Budget : “less than 500k$”

HOLDER IncomingCallServiceProvider

GOAL

CallServicesBeSupported

“Both Narrowband and Wideband voice, data and image services be supported.”

ATTRIBUTE

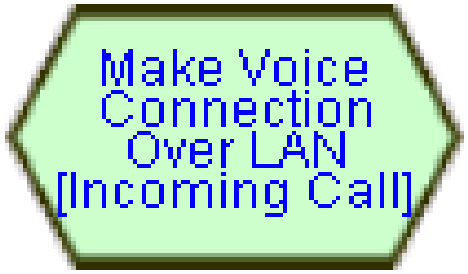
Object: TDMA

HOLDER

IncomingCallServiceProvider

*Time-division multiple access (**TDMA**) predstavlja metod za pristup kanalima za deljenje medijuma u mrežama.

Zadaci (tasks) u GRL-u



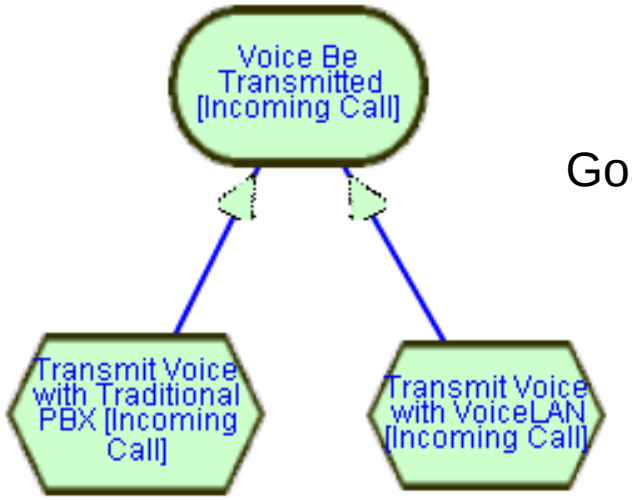
TASK
MakeVoiceConnectionOverLAN

ATTRIBUTE

Object: IncomingCall

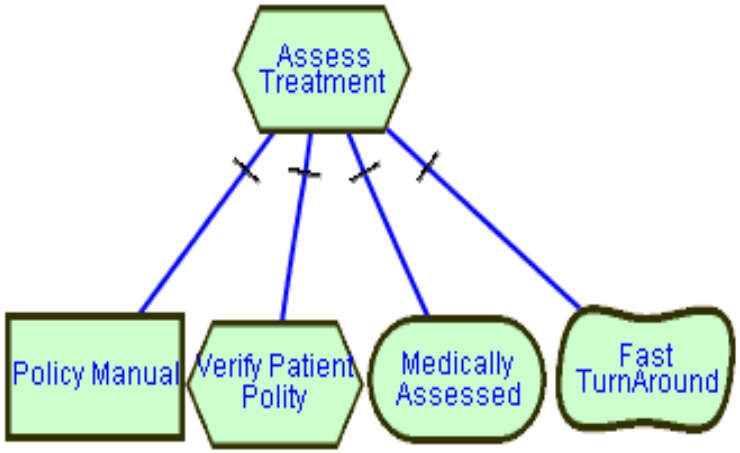
HOLDER
IncomingCallServiceProvider

Zadaci (tasks) u GRL-u



Goal Refinement: Means-ends Link

Task Refinement: Decomposition Link



Resource in GRL

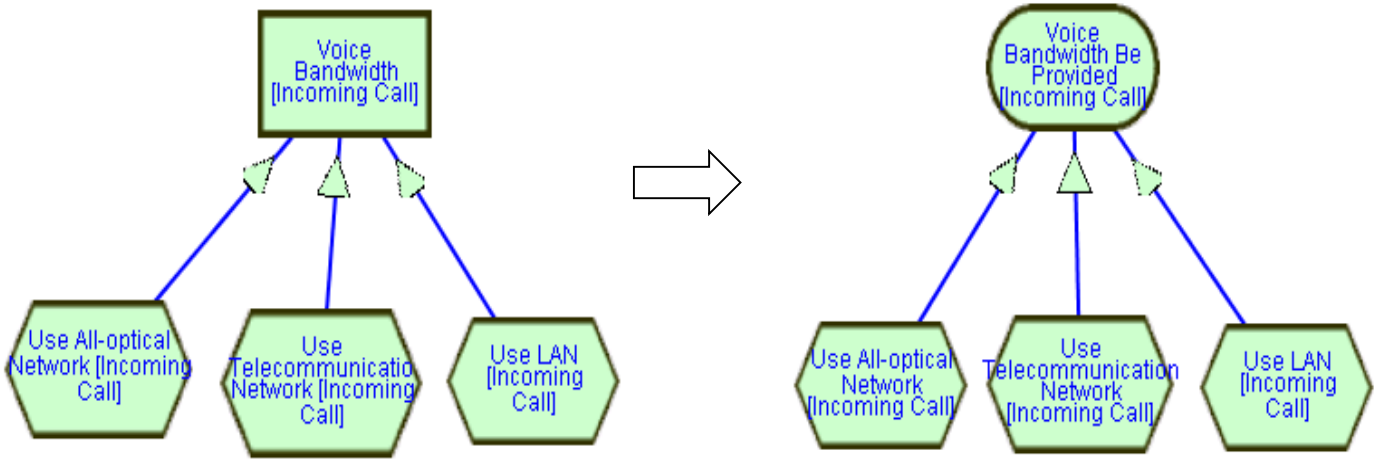
RESOURCE LANBandwidth

ATTRIBUTE

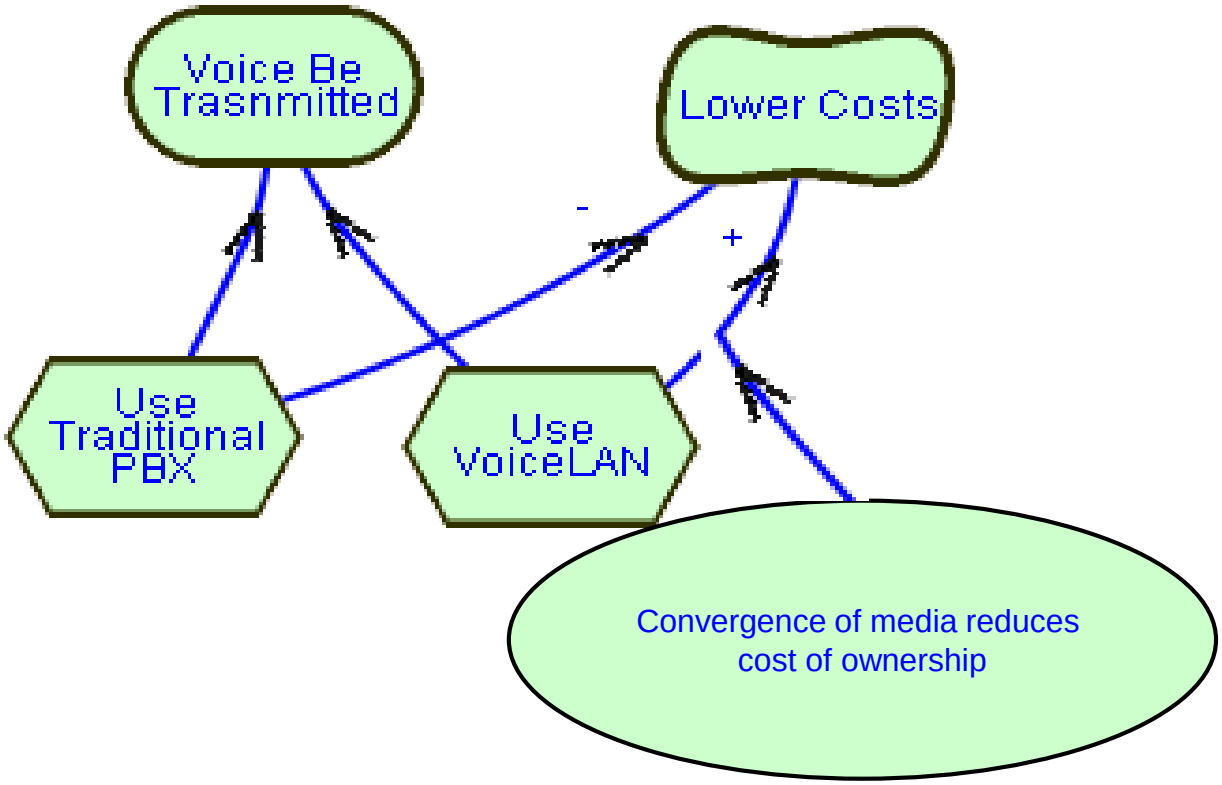
Object: VoiceCall

HOLDER

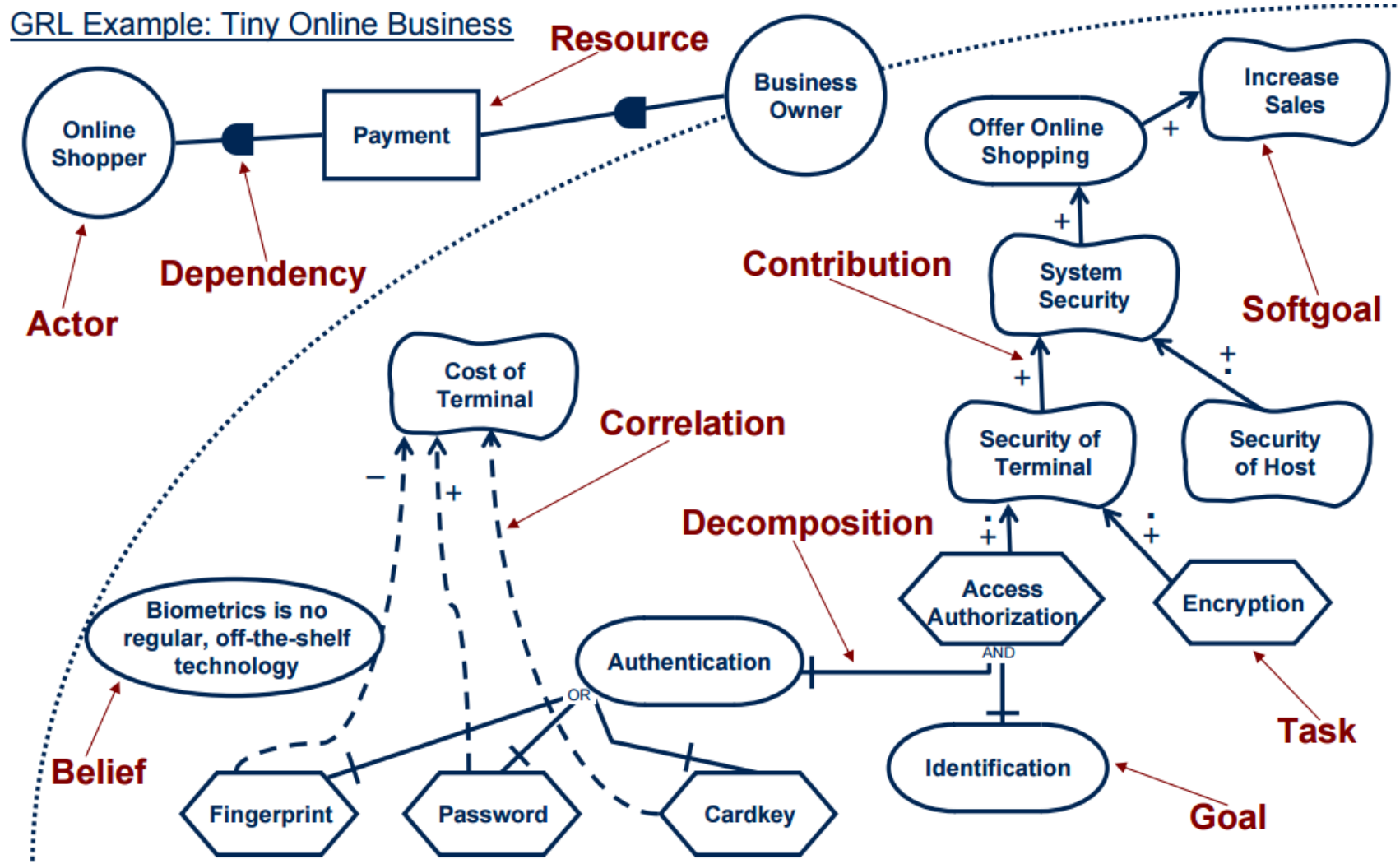
IncomingCallServiceProvider



Uverenje (Belief) u GRL-u



GRL primer


GRL Example: Tiny Online Business
Resource
Online Shopper
Payment
Business Owner
Actor
Dependency
Offer Online Shopping
Increase Sales
Contribution
System Security
Softgoal
Cost of Terminal
Correlation
Security of Terminal
Security of Host
Decomposition
Access Authorization
Encryption
Biometrics is no regular, off-the-shelf technology
Authentication
AND
OR
Task
Belief
Identification
Fingerprint
Password
Cardkey
Goal

Evaluacija GRL grafa

- **Evaluacija GRL grafova pokazuje uticaj kvalitativnih odluka o mekim ciljevima visokog nivoa**

- **Evaluacioni mehanizam uzima u obzir:**
  - Inicijalni nivo zadovoljenja elemenata na nižem nivou
  - Značaj definisan za elemente nižeg nivoa
  - Veze i tipove veza

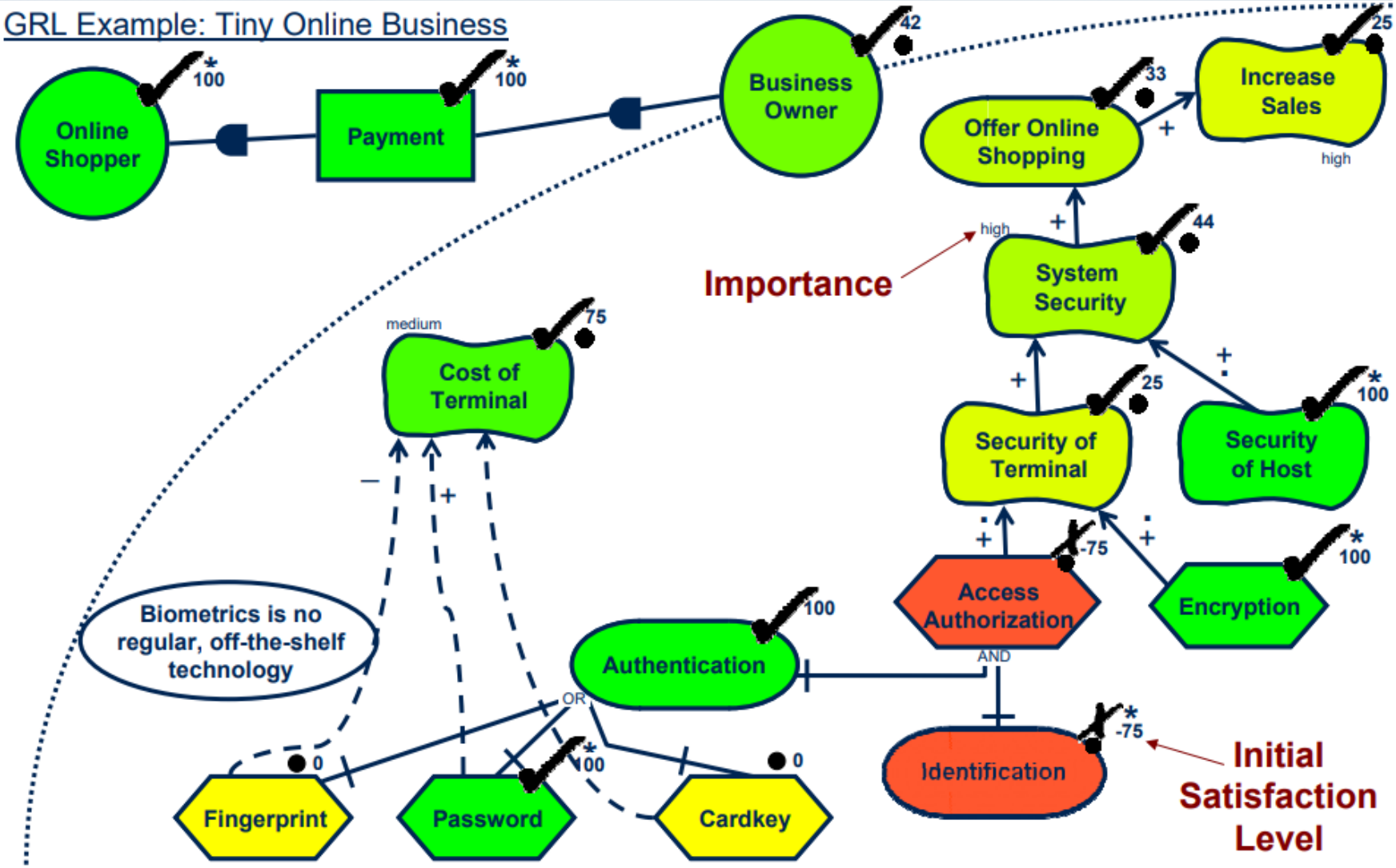
GRL: Kvalitativni i kvantitativni prilaz

- **Kvalitativni prilaz**
  - Tipovi doprinosa (contribution):
    - od Make do Break
  - Značaj: High, Medium, Low, ili None
  - Kvalitativni nivo zadovoljenja
- **Kvantitativni prilaz**
  - Tipovi doprinosa: [-100, 100]
  - Značaj: [0, 100]
  - Kvantitativni nivo zadovoljenja: [-100, 100]

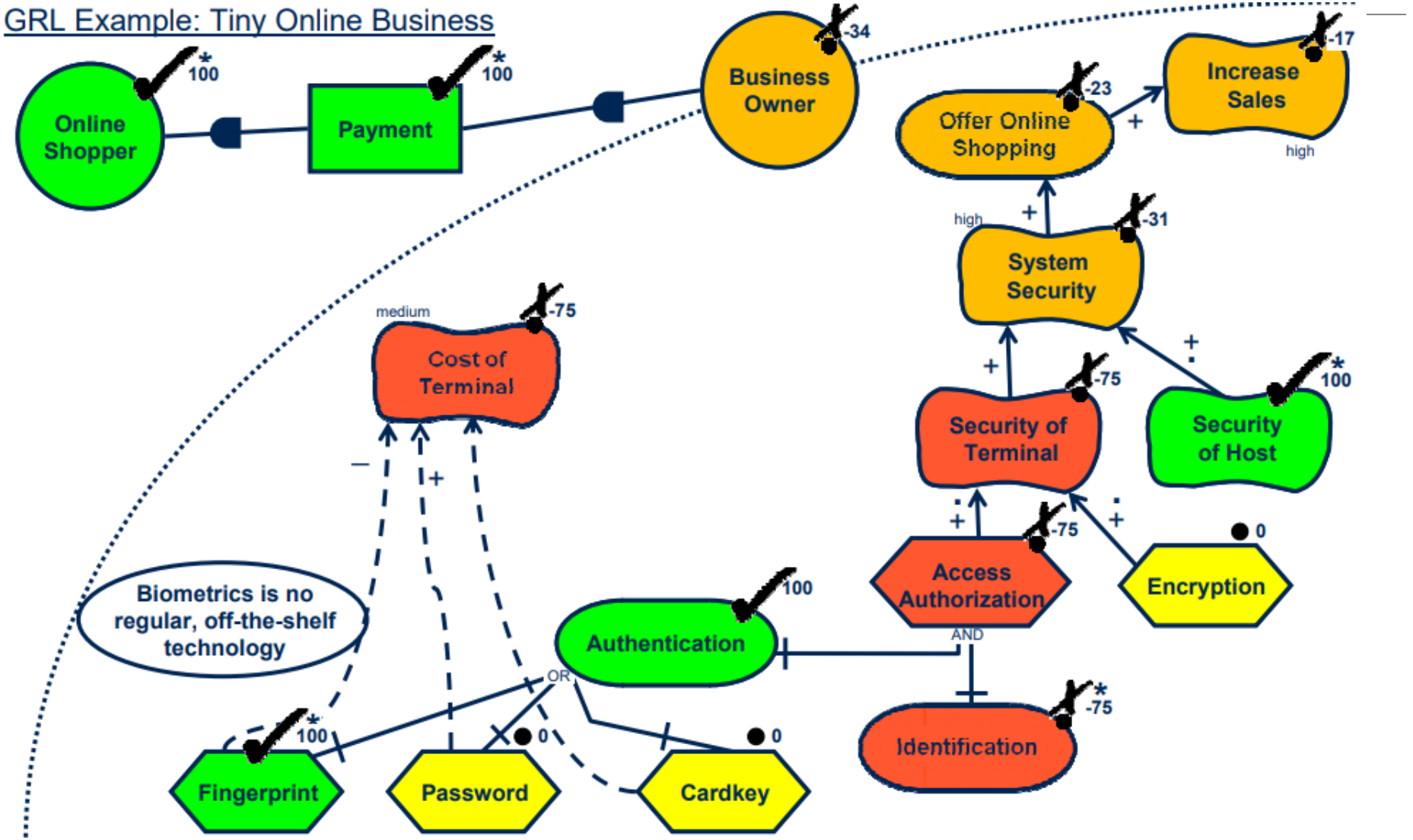
GRL: Kvalitativni i kvantitativni prilaz

- **Moguć je i hibridni prilaz**
  - Kvalitativni tipovi doprinosa
  - Kvantitativna važnost
  - Kvantitativni nivoi zadovoljenja

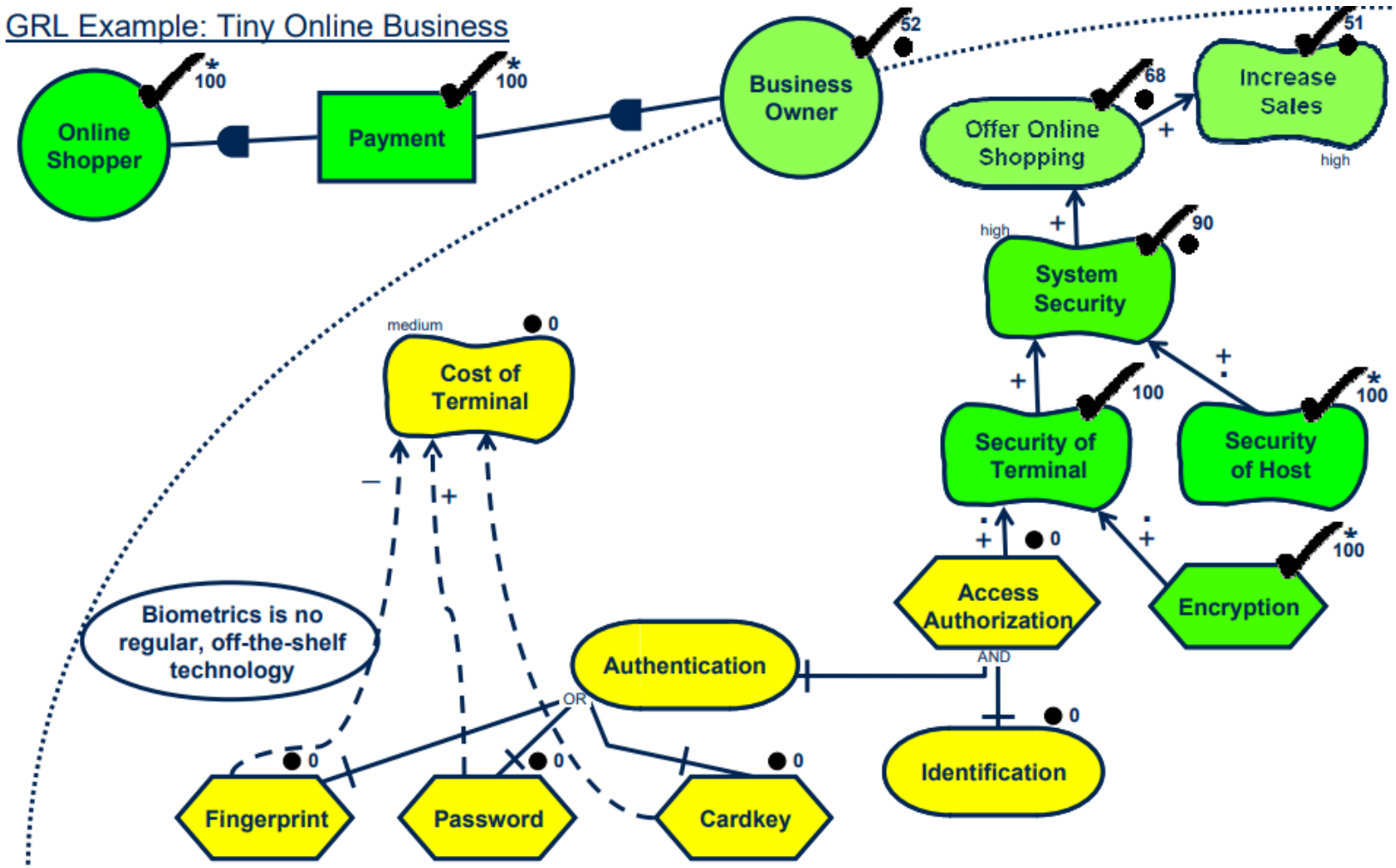
Strategija 1



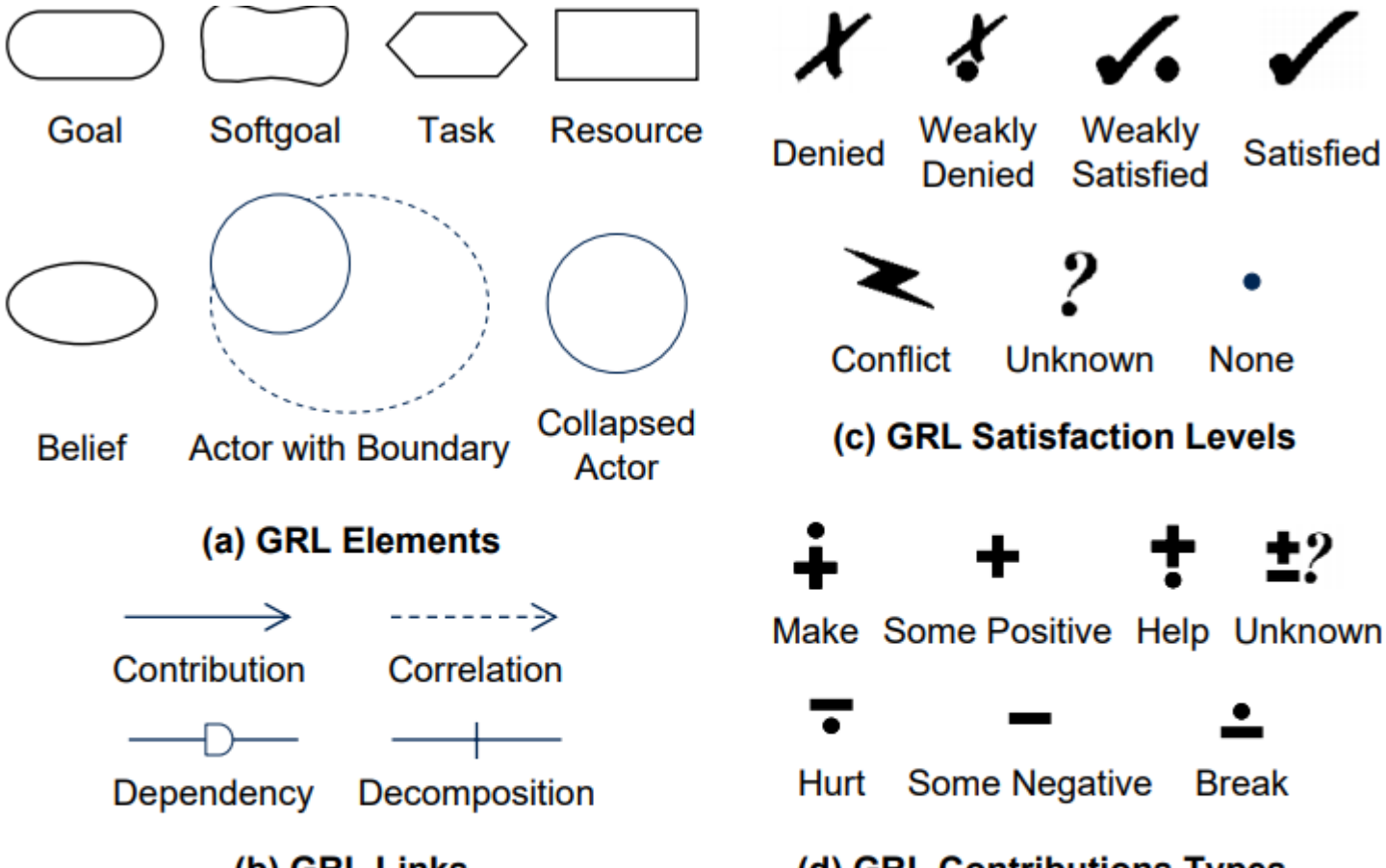
Strategija 2



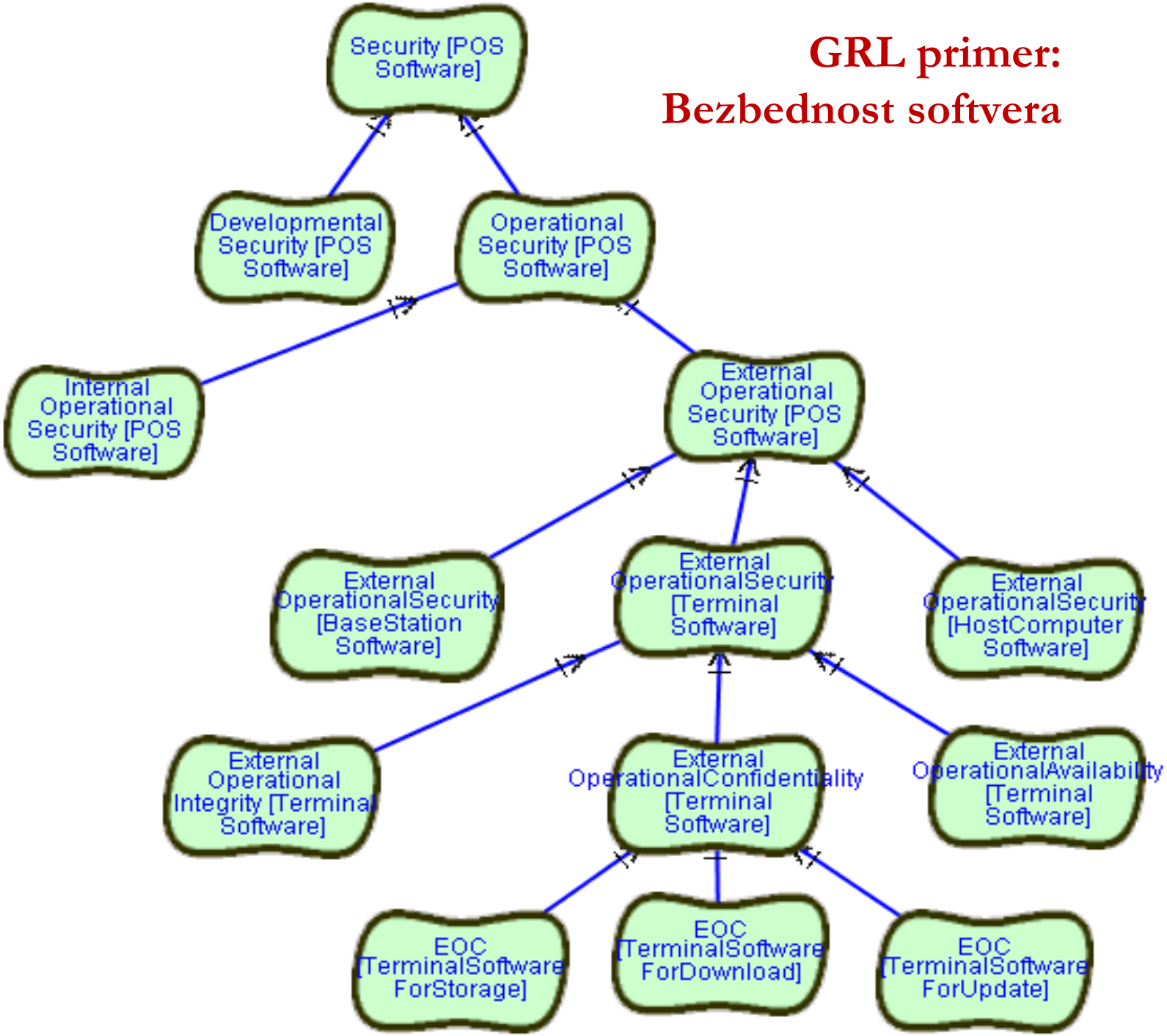
Strategija 3



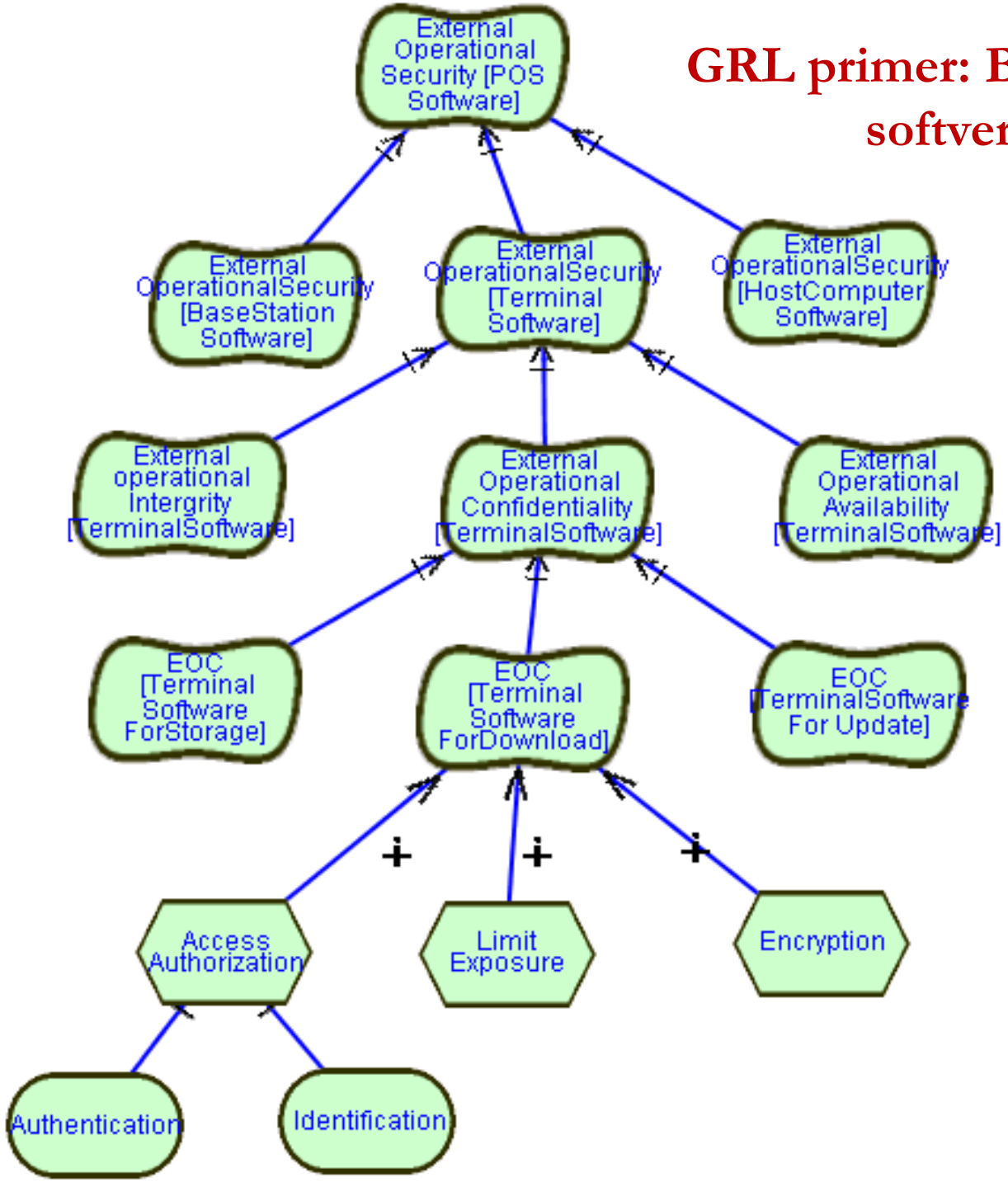
GRL Notacija



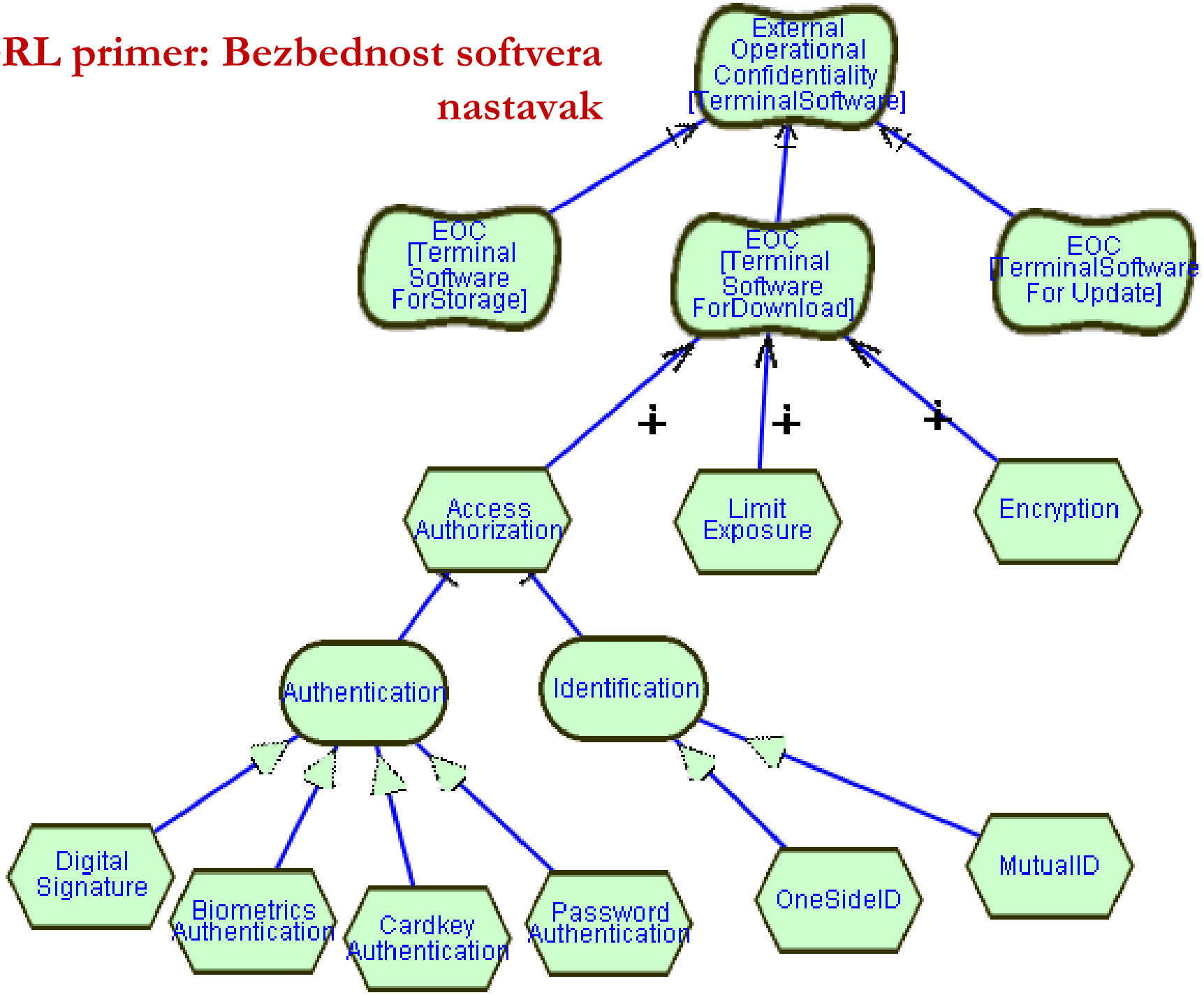
GRL primer: Bezbednost softvera



GRL primer: Bezbednost softvera nastavak

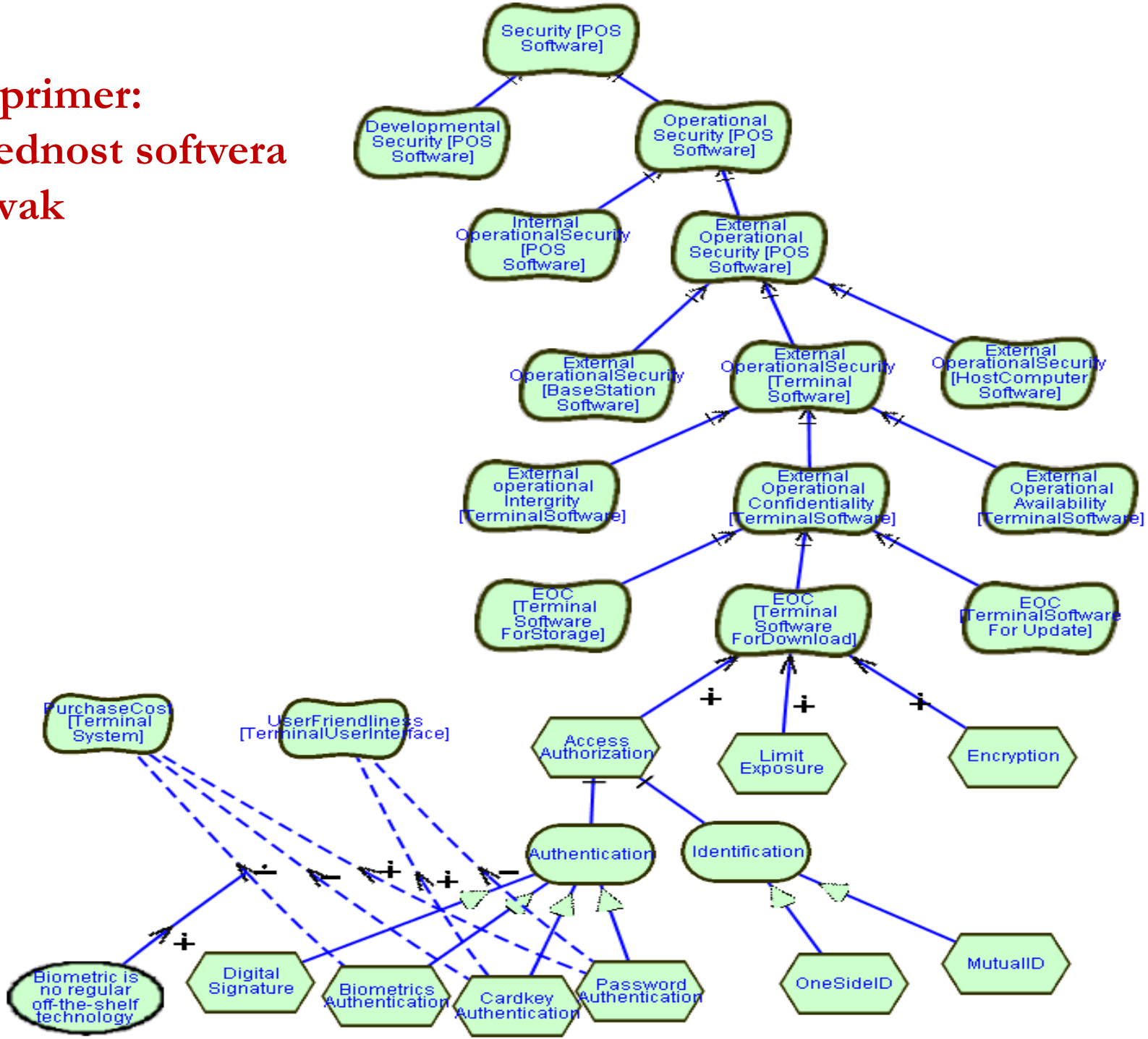


GRL primer: Bezbednost softvera nastavak



GRL primer: Bezbednost softvera

nastavak



GRL primer: Bezbednost softvera

- **Literatura:**

- https://www.site.uottawa.ca/~bochmann/SEG3101/Notes/SEG3101-ch3-5%20-%20Goal%20modeling%20-%20GRL.pdf
  - Str. 51-55

Šta je to UCM?

- **UCM je dijagram koji ima za cilj da povezuje ponašanje i strukturu sistema na eksplicitan i vizuelan način.**
- **UCM se sastoji od puteva koji su prva klasa arhitekturnih entiteta koji opisuju kauzalne veze između odgovornosti, koje su ograničene organizacionim strukturama apstraktnih komponenti.**
- **Putevi su scenariji koji veza između zahteva (različitih slučajeva) i detaljnog dizajna.**

UCM i UML dijagrami

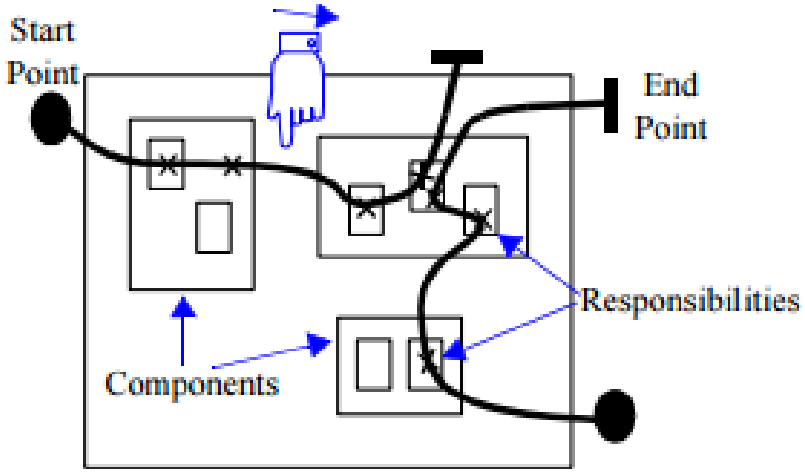
- **UCM dijagrami su slični UML dijagramima slučajeva (Use Case dijagramima) i oba se koriste u ranim fazama razvoja informacionog sistema.**
- **UCM je fleksibilniji od UML dijagrama aktivnosti i jednostavniji je i lakši za razumevanje**
- **UCM se može prevesti u UML sekvencijalni dijagram**

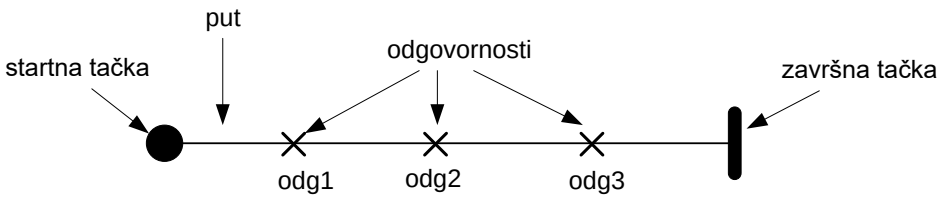
Konstruisanje UCM dijagrama

- **Šta nam je potrebno za konstruisanje UCM dijagrama?**
  - Zahtevi sistema
  - Odgovornosti koje predstavljaju funkcionalnosti sistema
  - Specificiranje interfejsa između okruženja i sistema
    - Ova specifikacija vodi startnim i krajnjim tačkama odgovarajućeg slučaja sistema i odgovara razmeni poruka između sistema i okruženja. Poruke se dalje opisuju u modelima u okviru detaljnog dizajna, kao što je npr. UML Sekvencijalni dijagram.

UCM notacija

- **Elementi i komponente UCM dijagrama**

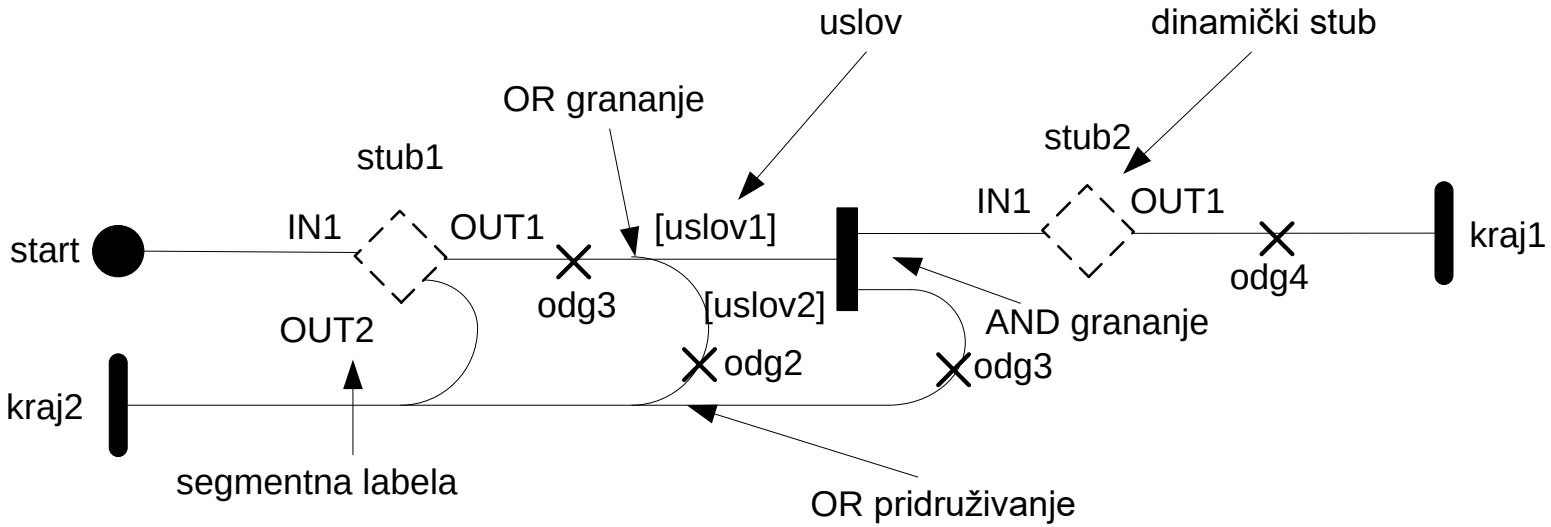




- ✓ startne tačke (start points)
  - predstavlja preduslov
  - grafička reprezentacija: popunjen krug
- ✓ odgovornosti (responsibilities)
  - predstavlja akcije, zadatke i funkcije koje treba izvršiti
  - grafička reprezentacija: oblik krsta
- ✓ krajnje tačke (end points)
  - Predstavlja rezultat ili završetak
  - grafička reprezentacija: oblik uspravnog štapa
- ✓ komponente
  - predstavlja objekte koji sačinjavaju sistem
  - grafička reprezentacija: pravougaonog je oblika

UCM notacija

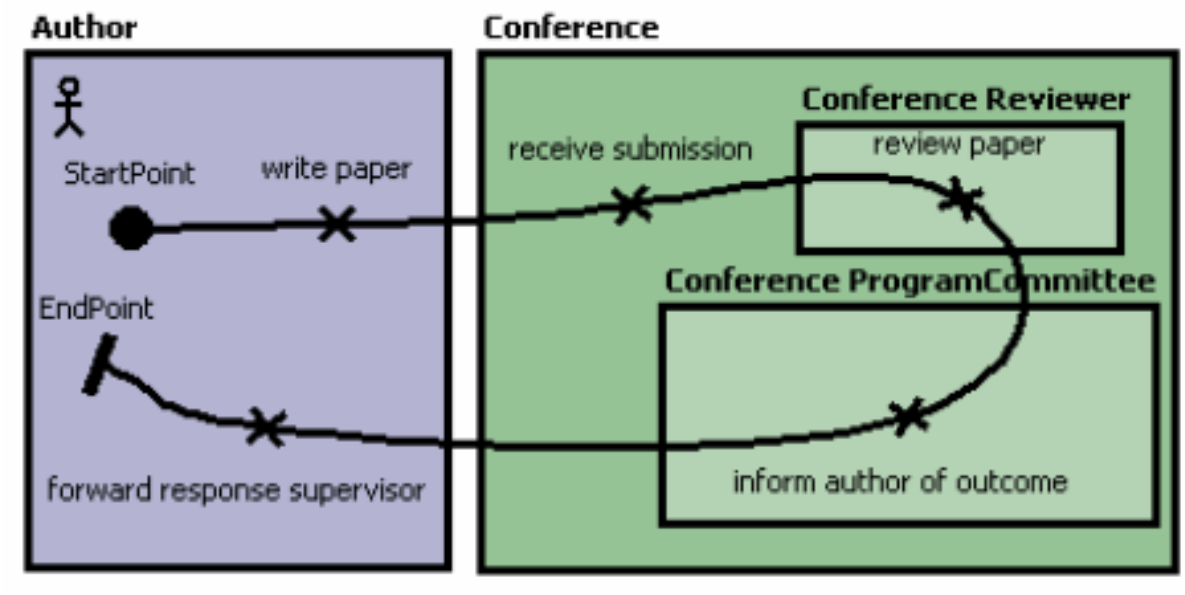
- **OR- pridruživanje (OR-join), OR- grananje (OR-fork), AND- pridruživanje (AND-join), AND-grananje (AND-fork), tajmer (timer), prekid (abort), tačka neuspeha (failure point).**



UCM primer

- **Primer jednostavnog Use Case-a**

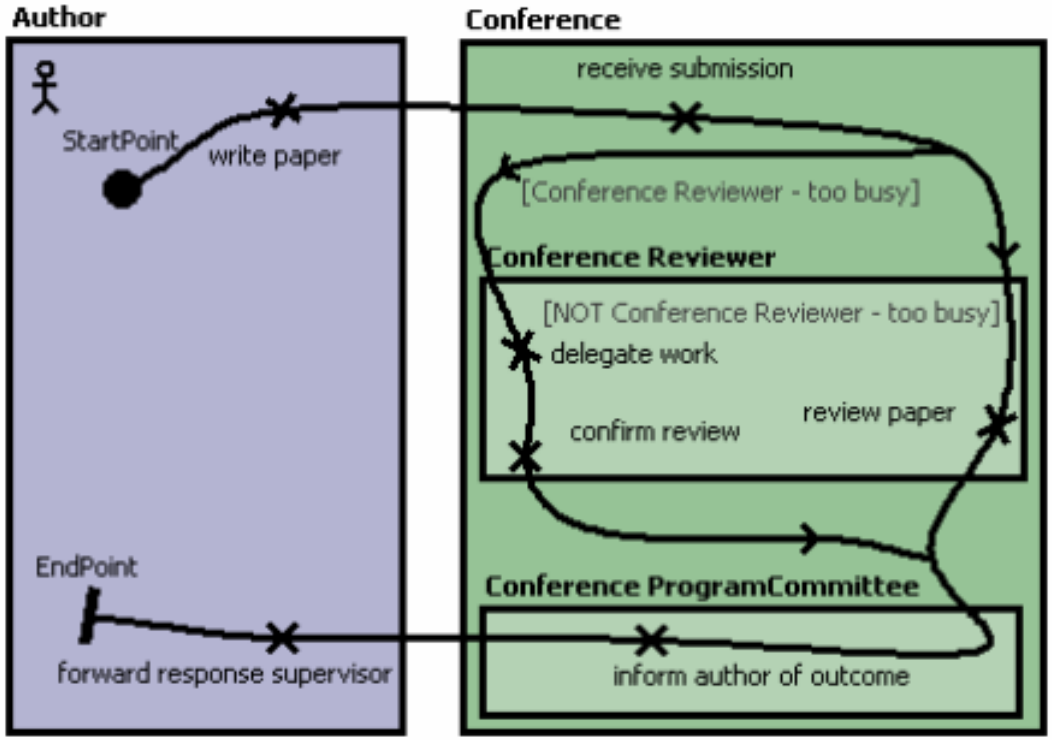
Title: PaperSubmission
1. Author writes a paper
2. Conference receives submission
3. Conference Reviewer reviews the paper
4. Conference ProgramCommittee informs author of outcome
5. Author forwards response to supervisor



UCM primer

- **Primer Use Case-a sa alternativama**

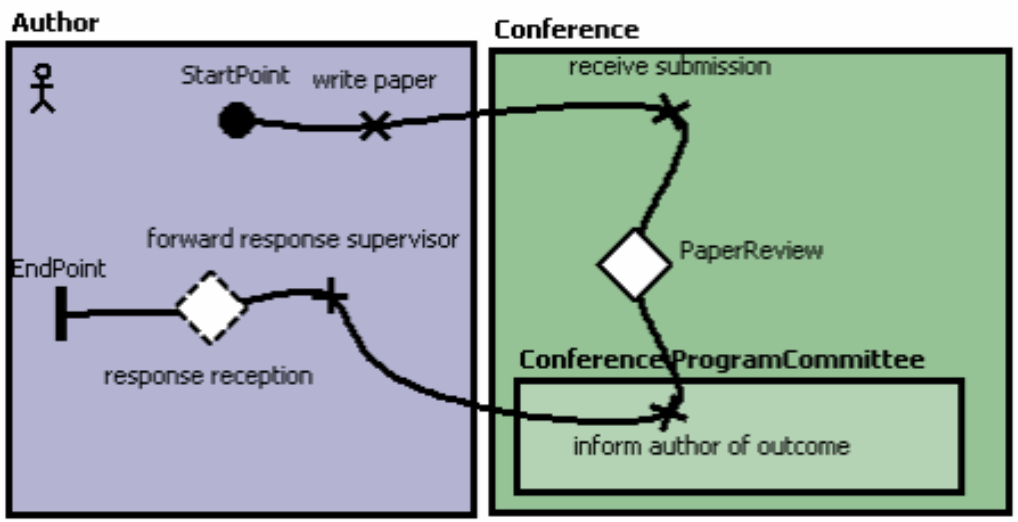
Title: PaperSubmission
1. Author writes a paper
2. Conference receives submission
3. Conference Reviewer reviews the paper
4. Conference ProgramCommittee informs author of outcome
5. Author forwards response to supervisor
2. a. Conference Reviewer is too busy
2. a. 1. Conference Reviewer delegates work
2. a. 2. Conference Reviewer confirms review
2. a. 3. GOTO 4



UCM primer

- **Primer Use Case-a sa inkluzijom i ekstenzionom tačkom**

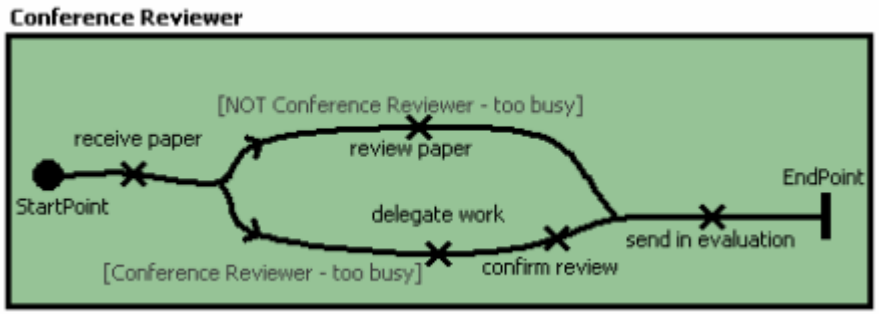
Title: PaperSubmission
1. Author writes a paper
2. Conference receives submission
3. Conference Reviewer reviews the paper
4. Conference ProgramCommittee informs author of outcome
5. Author forwards response to supervisor
2. a. Conference Reviewer is too busy
2. a. 1. Conference Reviewer delegates work
2. a. 2. Conference Reviewer confirms review
2. a. 3. GOTO 4



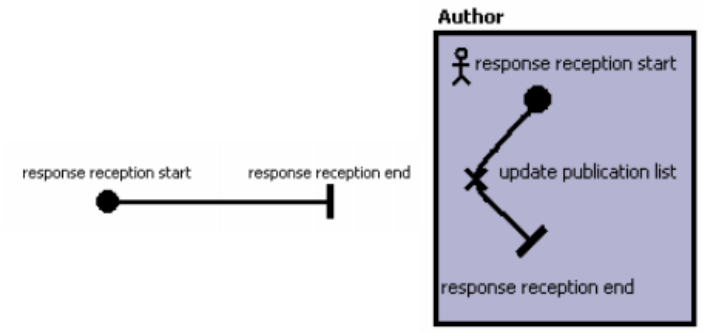
UCM primer

- **Primer Use Case-a sa uključenim Use Case-om**

Title: PaperReview
1. Conference Reviewer receives paper
2. Conference Reviewer reviews the paper
3. Conference Reviewer sends in evaluation
1. a. Conference Reviewer is too busy
1. a. 1. Conference Reviewer delegates work
1. a. 2. Conference Reviewer confirms review
1. a. 3. GOTO 3



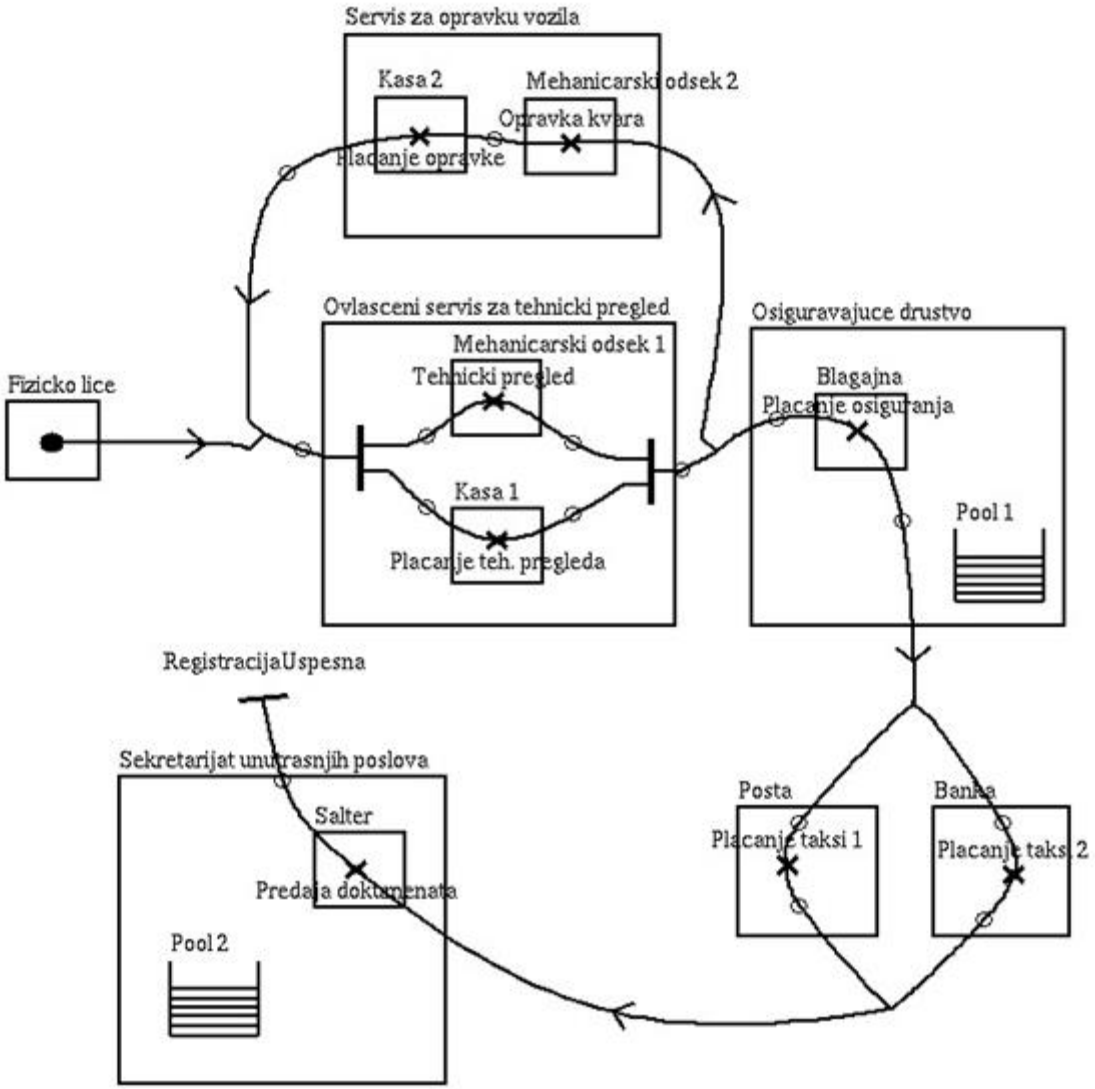
- **Ekstenzioni Use Case**



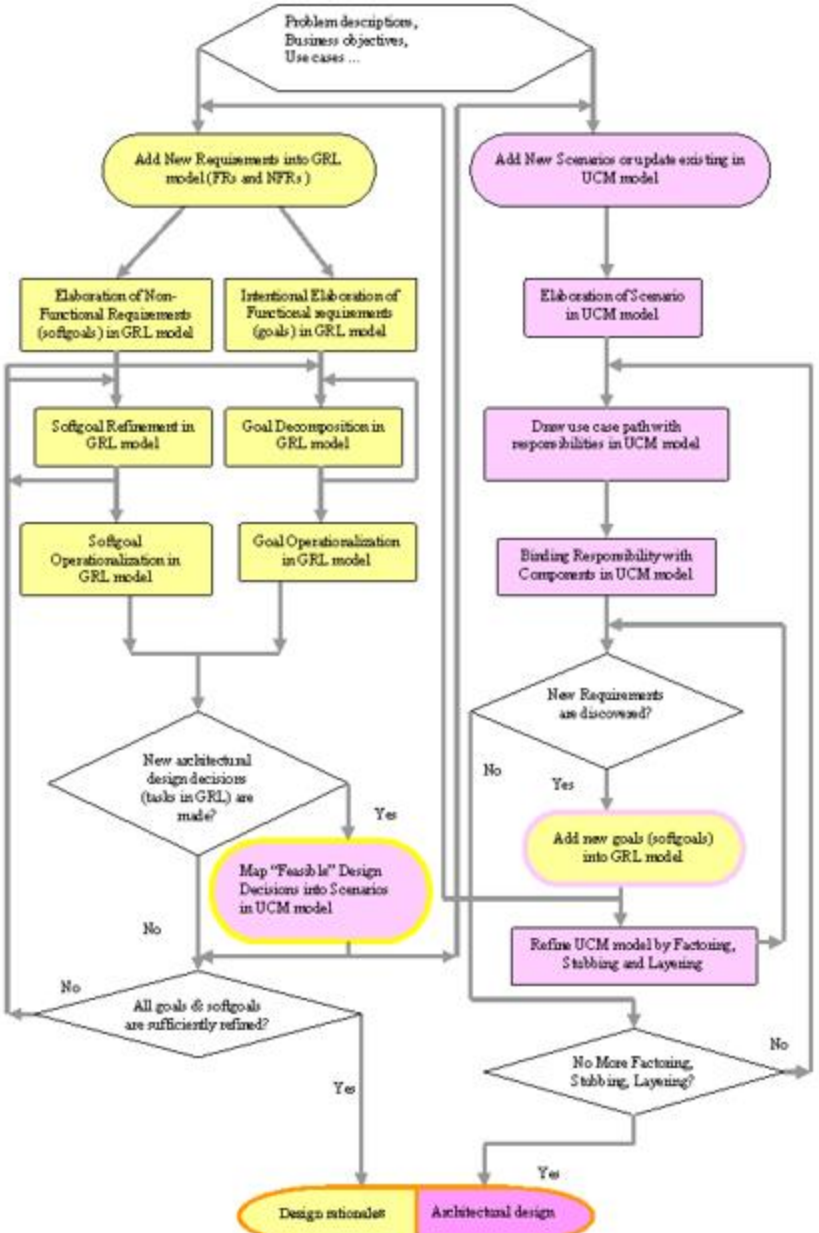
Title: PaperReception
PART 1. At Extension Point response reception
1. Author updates publication list

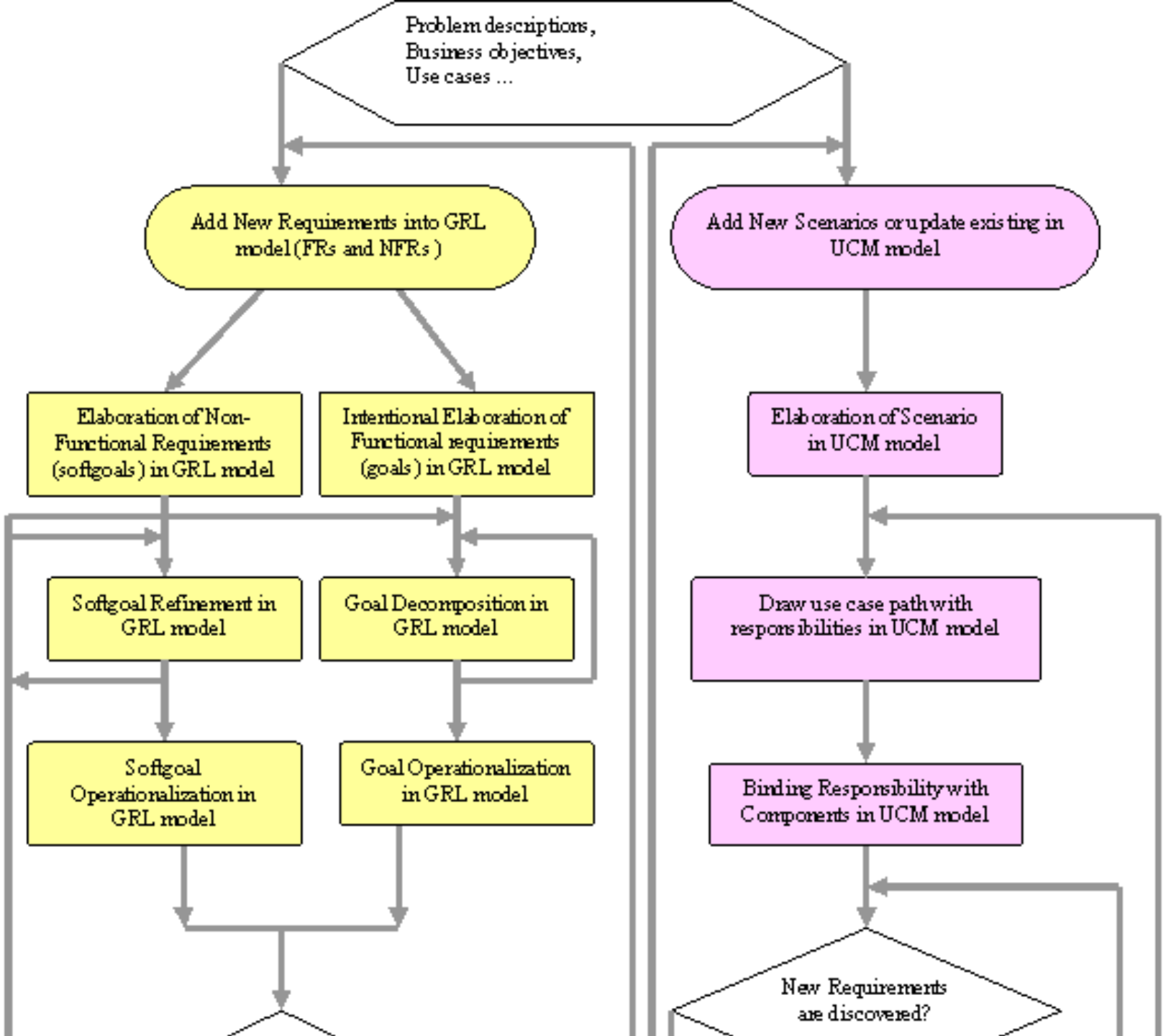
UCM primer

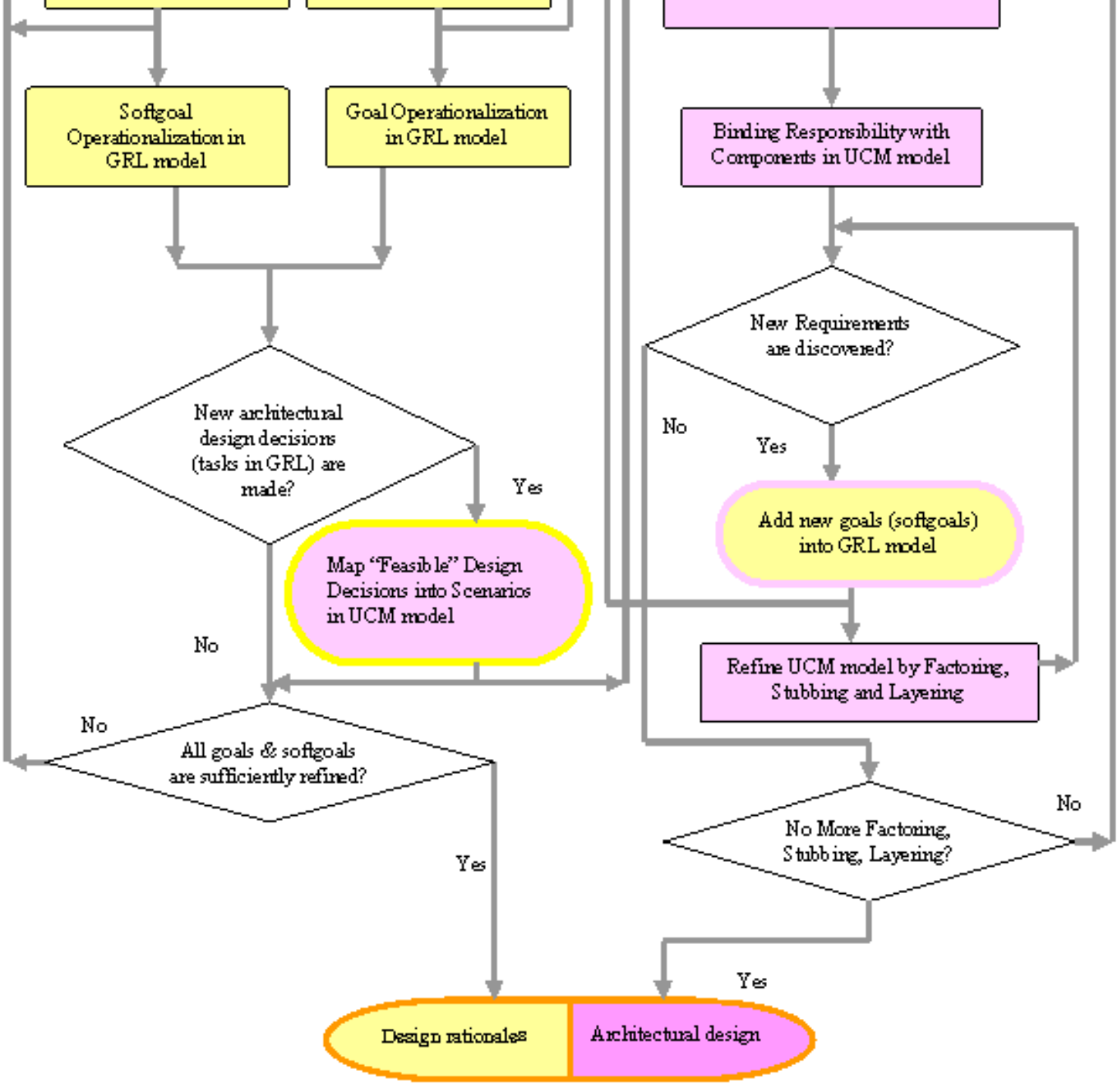
UCM dijagram procesa registracije vozila



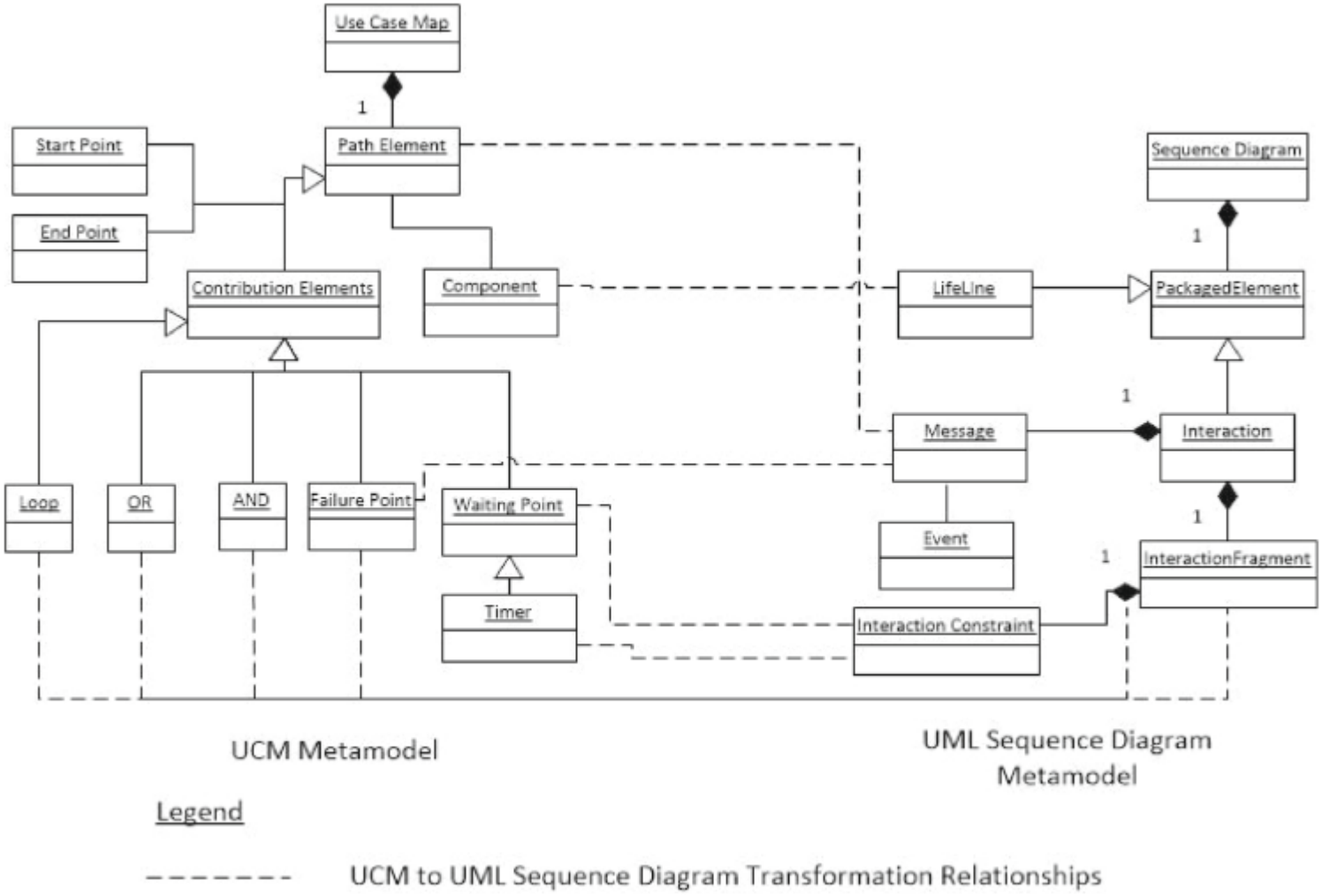
Integracija GRL i UCM zasnovanog modelovanja



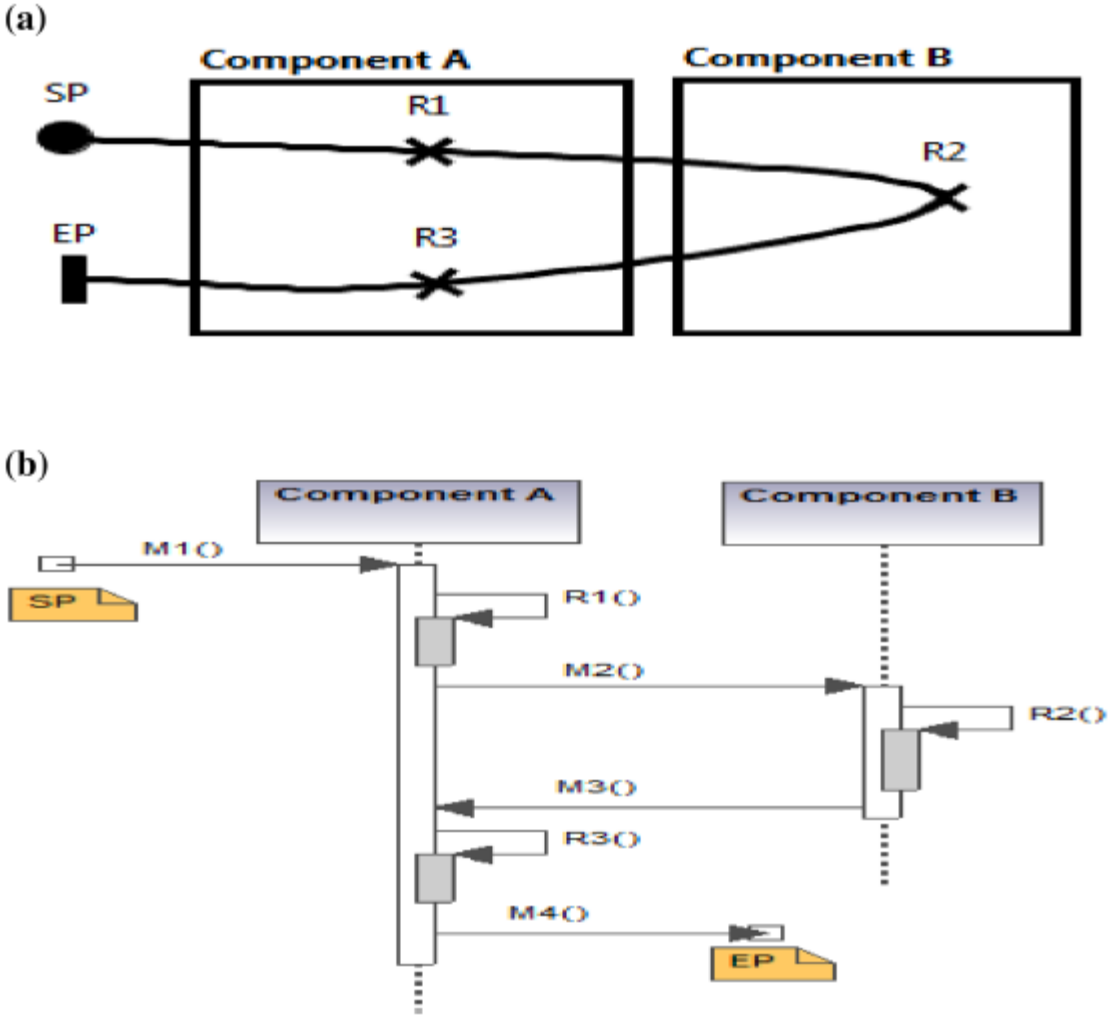

Problem descriptions,
Business objectives,
Use cases ...
Add New Requirements into GRL model (FRs and NFRs)
Add New Scenarios or update existing in UCM model
Elaboration of Non-Functional Requirements (softgoals) in GRL model
Intentional Elaboration of Functional requirements (goals) in GRL model
Softgoal Refinement in GRL model
Goal Decomposition in GRL model
Softgoal Operationalization in GRL model
Goal Operationalization in GRL model
Elaboration of Scenario in UCM model
Draw use case path with responsibilities in UCM model
Binding Responsibility with Components in UCM model
New Requirements are discovered?


Softgoal Operationalization in GRL model
Goal Operationalization in GRL model
Binding Responsibility with Components in UCM model
New architectural design decisions (tasks in GRL) are made?
Yes
Map "Feasible" Design Decisions into Scenarios in UCM model
No
New Requirements are discovered?
No
Yes
Add new goals (softgoals) into GRL model
Refine UCM model by Factoring, Stubbing and Layering
No
All goals & softgoals are sufficiently refined?
No
No More Factoring, Stubbing, Layering?
No
Yes
Yes
Design rationales
Architectural design

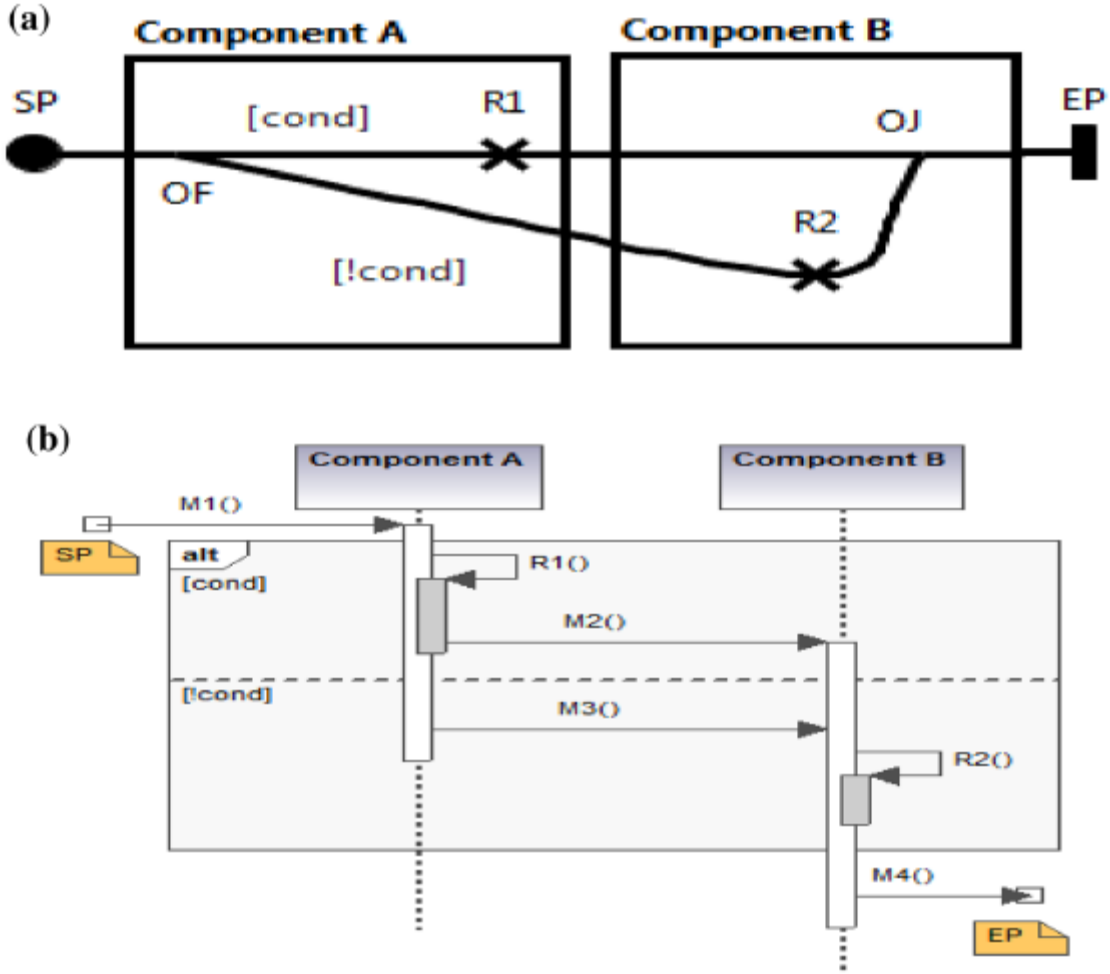
Generisanje UML Sekvencijalnog dijagrama (SD) iz UCM-a



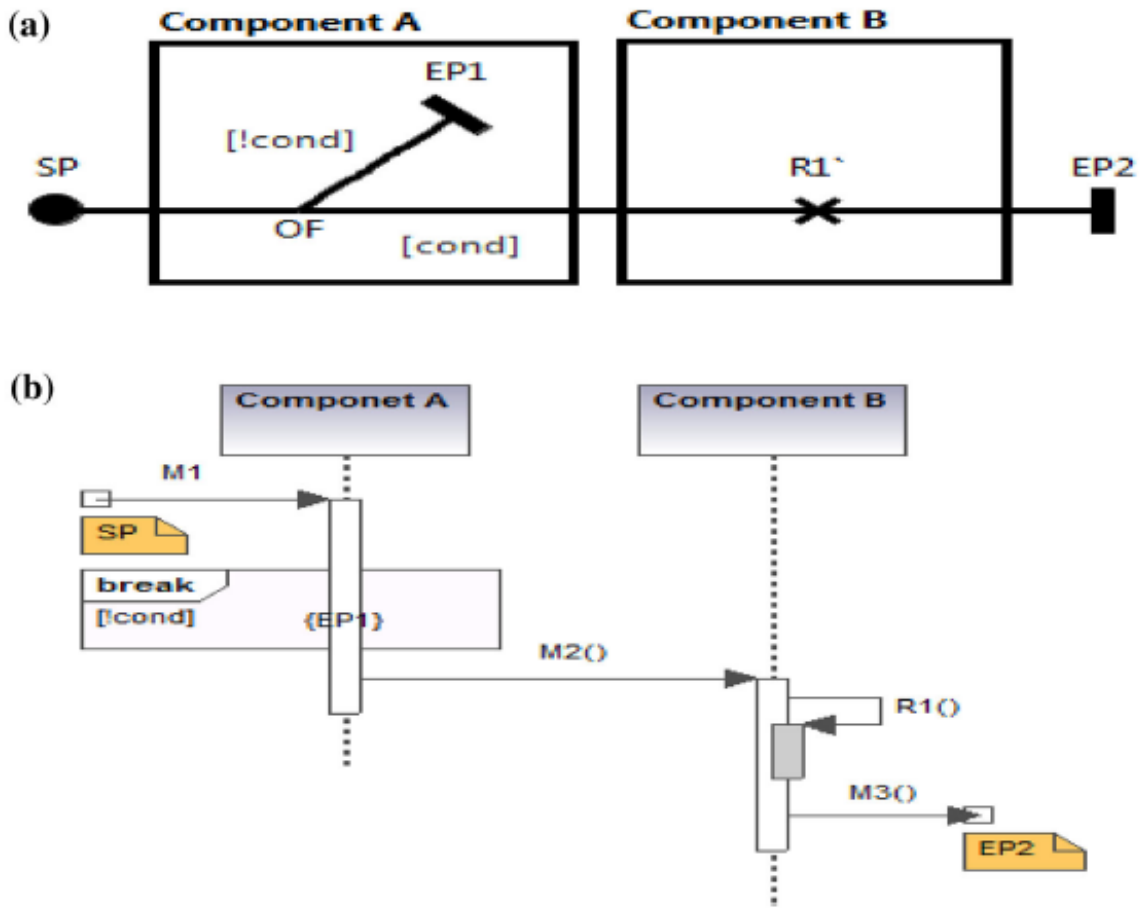
Mapiranje UCM na SD



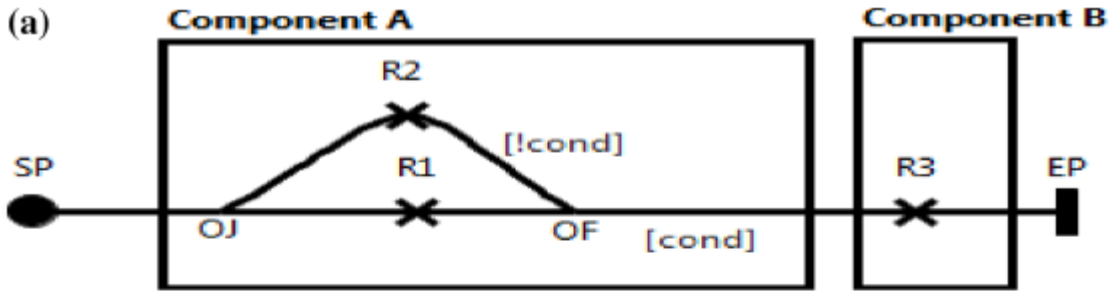
Mapiranje UCM na SD (OR fork-OF)

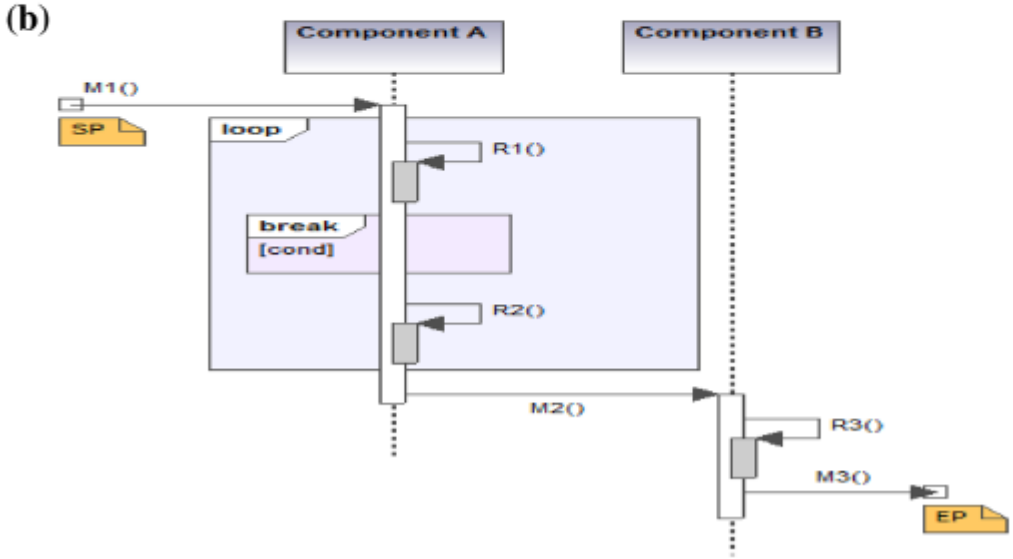


Mapiranje UCM na SD

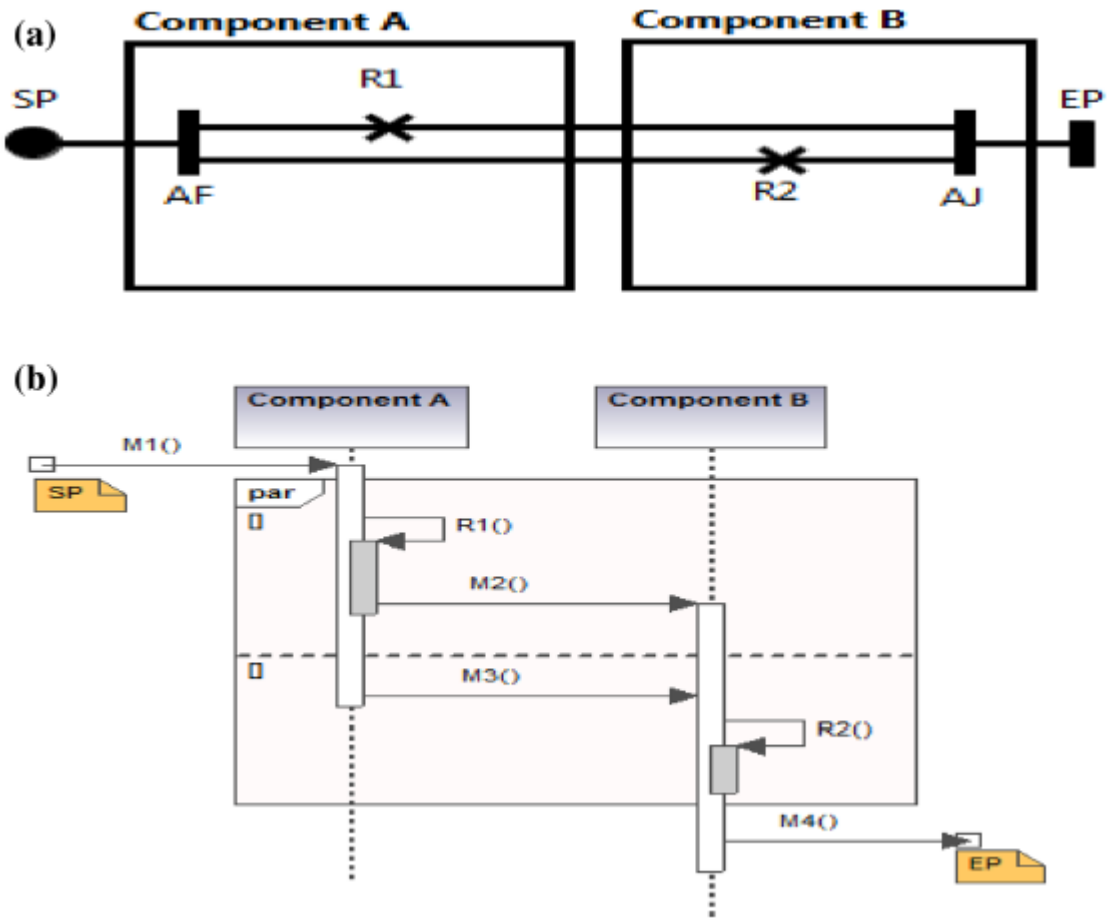


Mapiranje UCM na SD

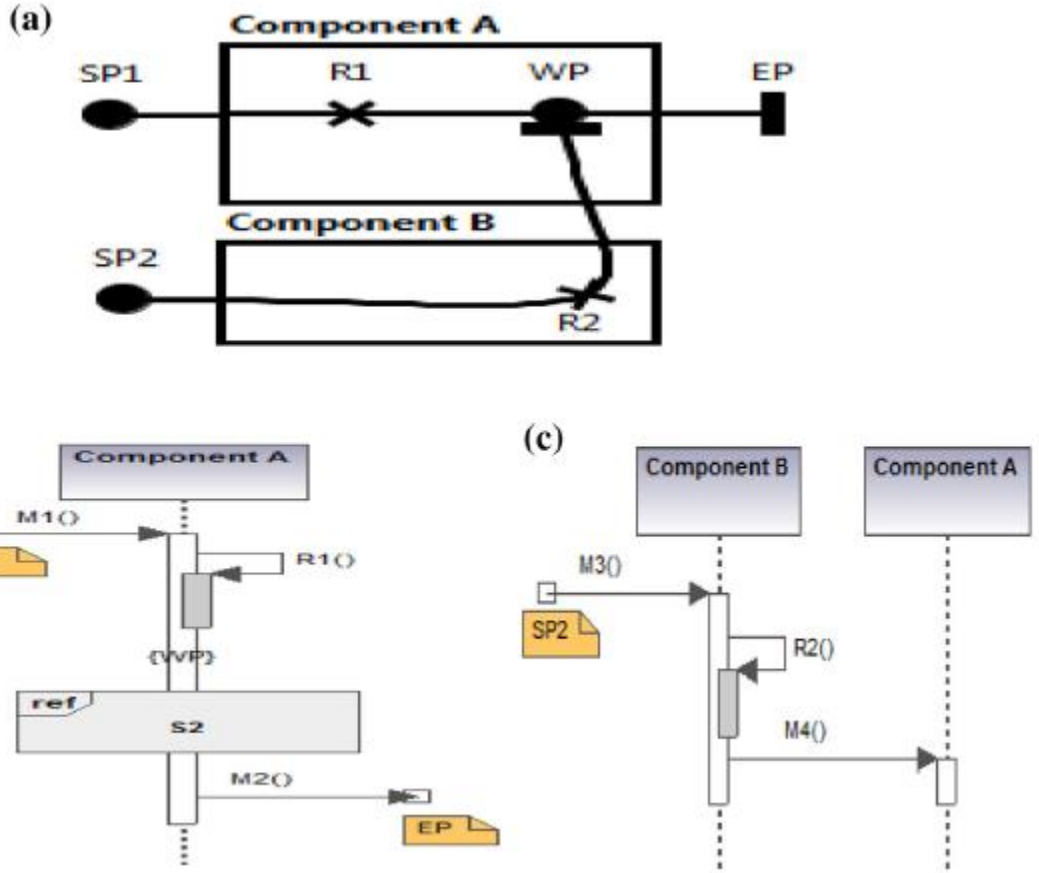




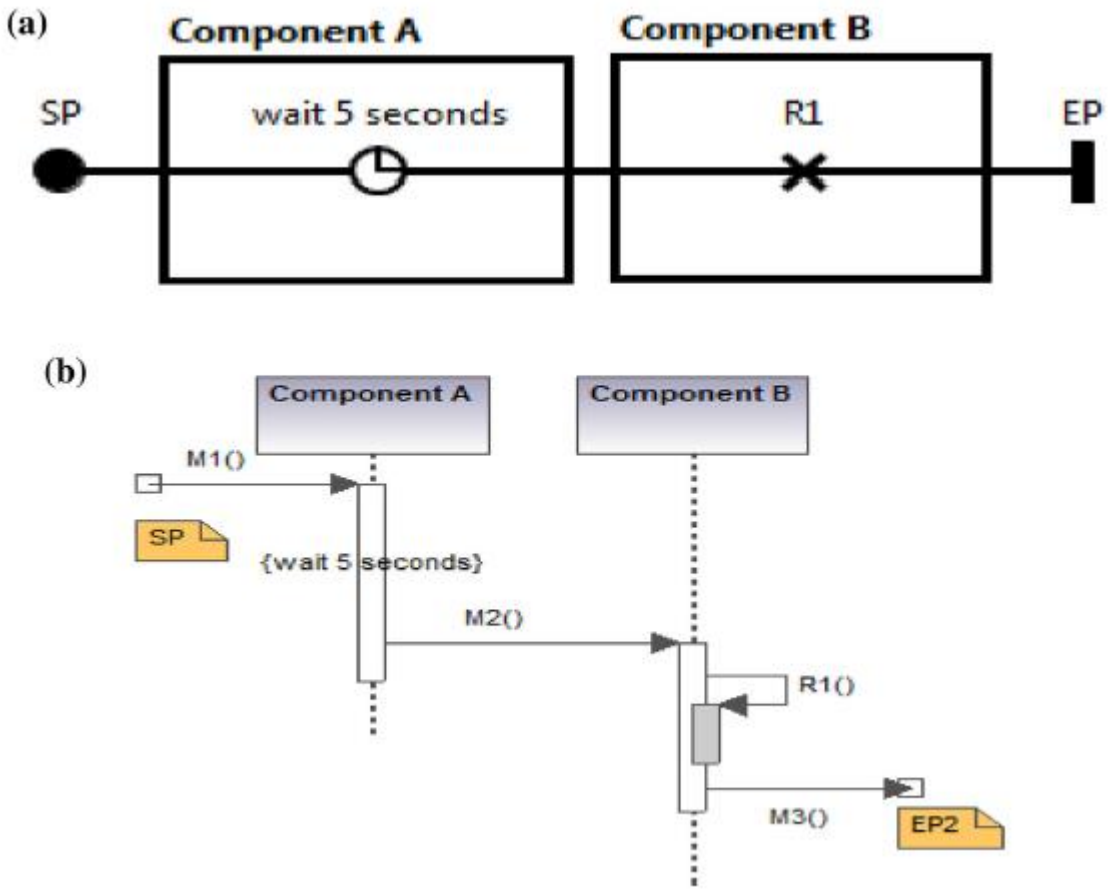
Mapiranje UCM na SD



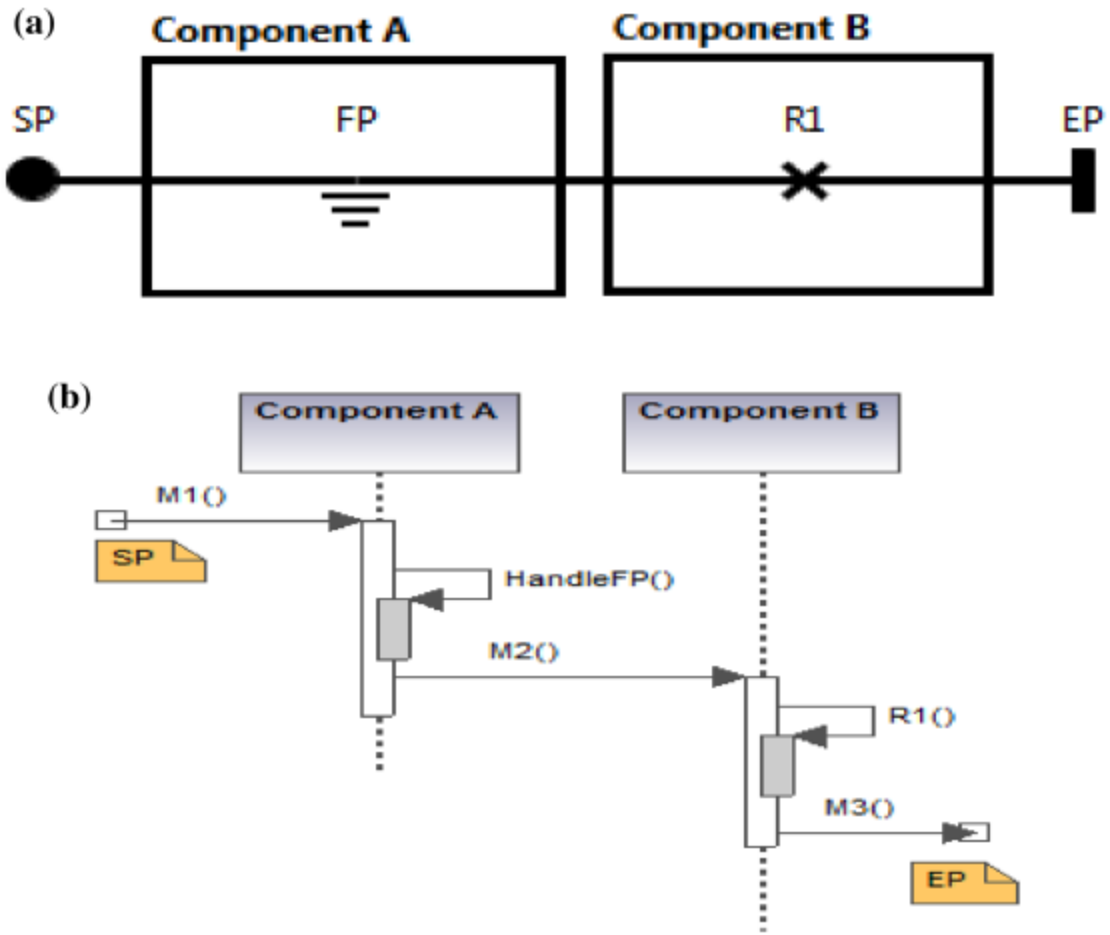
Mapiranje UCM na SD



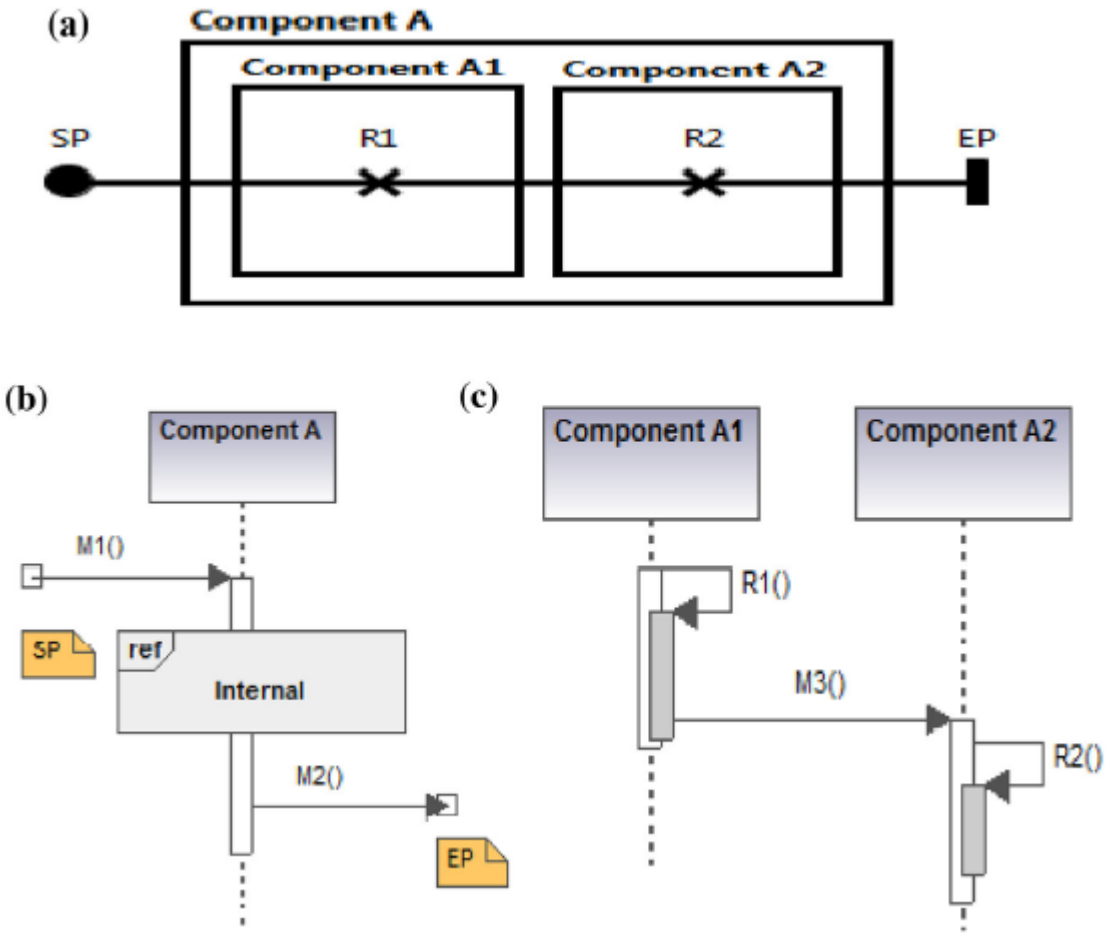
Mapiranje UCM na SD



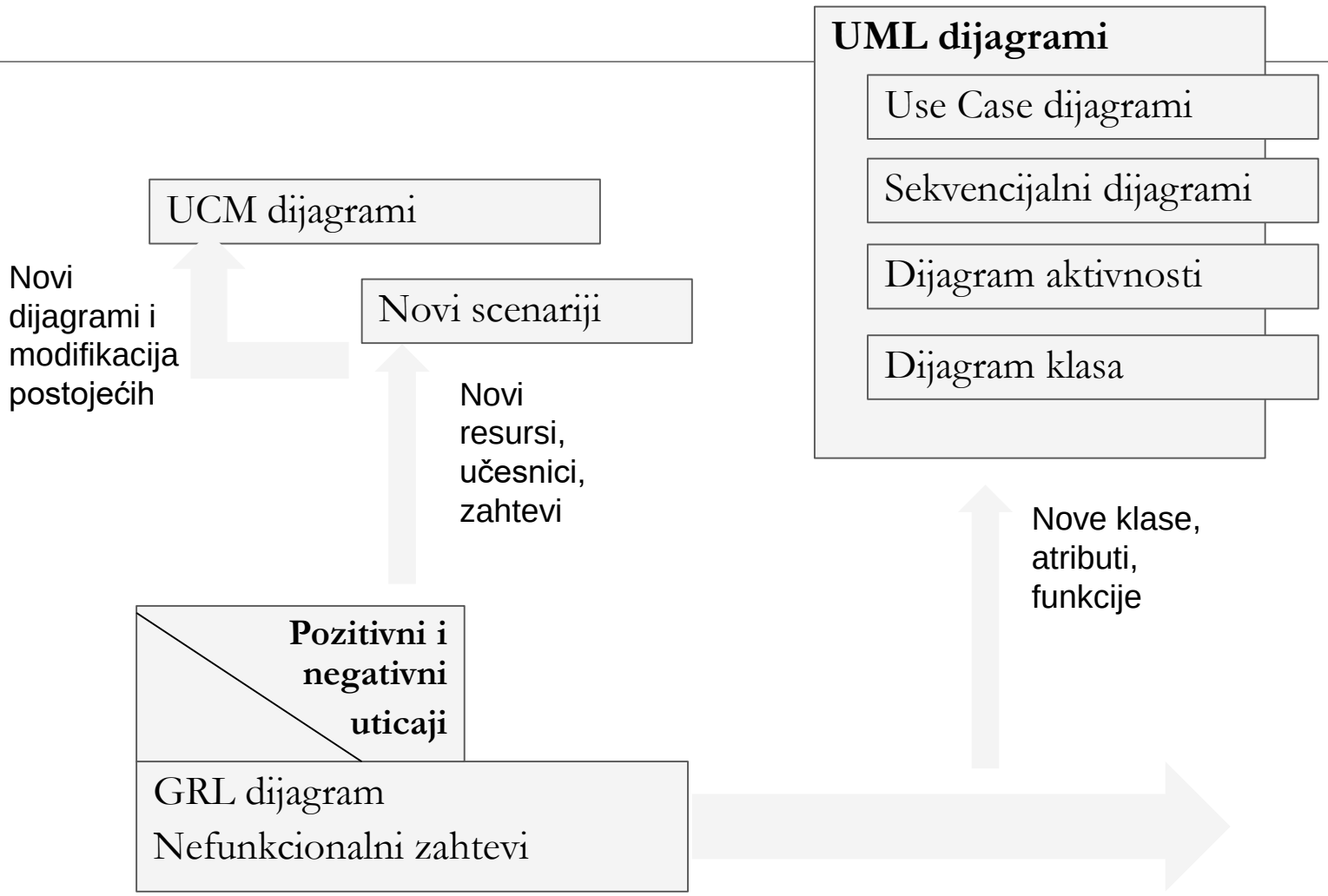
Mapiranje UCM na SD: Failure point (FP)



Mapiranje UCM na SD



Rezime: Strategija razvoja informacionog sistema upotrebom URN, GRL i UML dijagrama



Alat za crtanje UCM i GRL: jUCMNav

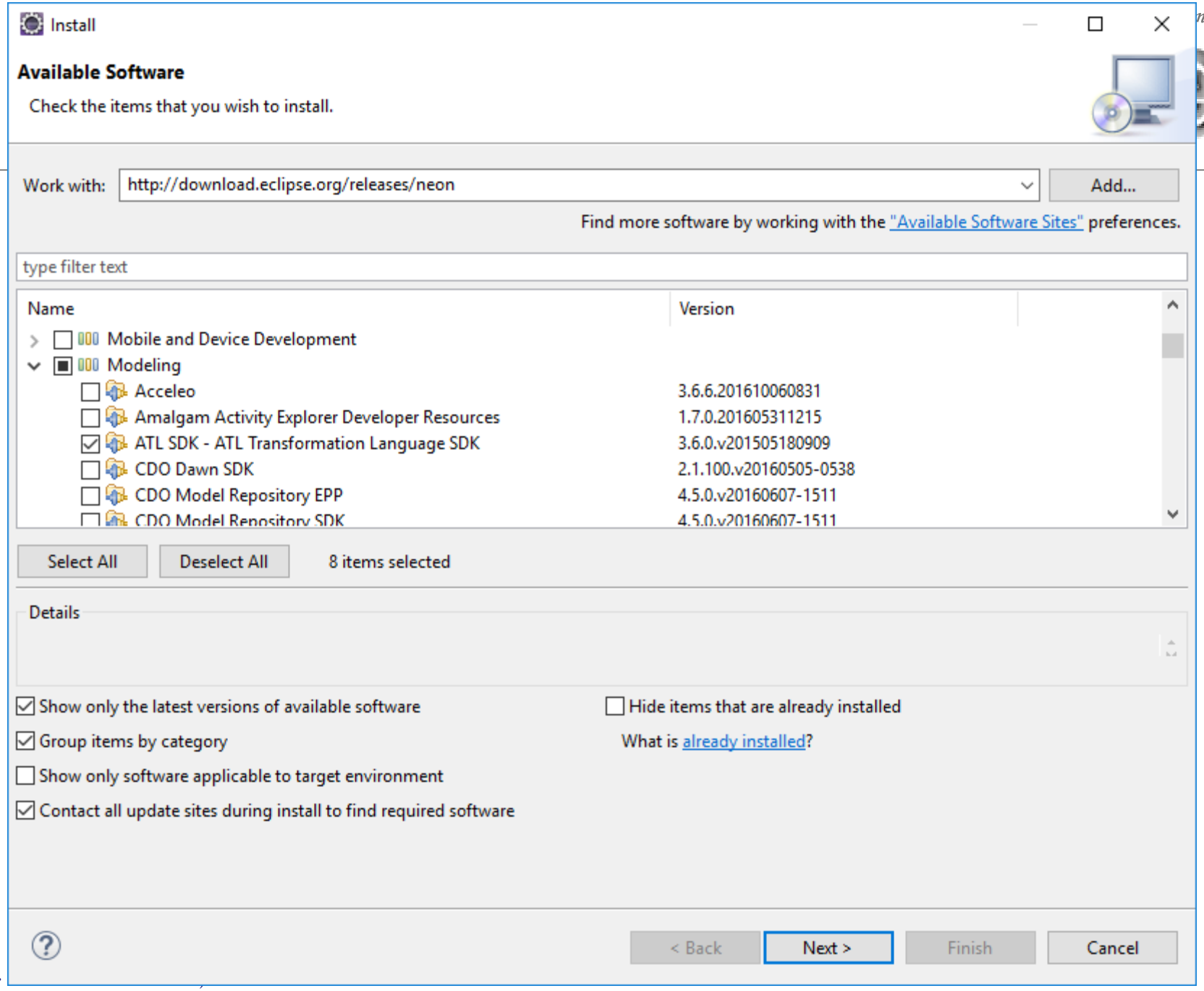
- **Eclipse jUCMNav plugin**
  - Uputstvo za instalaciju je u okviru prezentacije OVezbama.pdf
  - Napomena: preduslov je instalacija Graphviz plugin-a

jUCMNav video-uputstva

- **Kreiranje puta, komponenti, stub i plugin mapa**
  - https://www.youtube.com/watch?v=kuXvxmcfzh8
- **Dodavanje grananja (forks) i spajanja (joins)**
  - https://www.youtube.com/watch?v=LeDUx4TWyss
- **Petlje i poboljsanje scenarija**
  - https://www.youtube.com/watch?v=hvNbLK_a7I4
- **Tajmeri**
  - https://www.youtube.com/watch?v=9sUiym0SMT0
- **Dinamički stub-ovi**
  - https://www.youtube.com/watch?v=KA9eSqDj4Xc

Automatsko prevođenje UCM u SD

- Eclipse ATL i GMF plug-in
  - Modeling deo u update-u za Eclipse
- UML editor u Eclipse-u:
  - UML 2 tool ili Papyrus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Modeling
Acceleo
3.6.6.201610060831
Amalgam Activity Explorer Developer Resources
1.7.0.201605311215
ATL SDK - ATL Transformation Language SDK
3.6.0.v201505180909
CDO Dawn SDK
2.1.100.v20160505-0538
CDO Model Repository EPP
4.5.0.v20160607-1511
CDO Model Repository SDK
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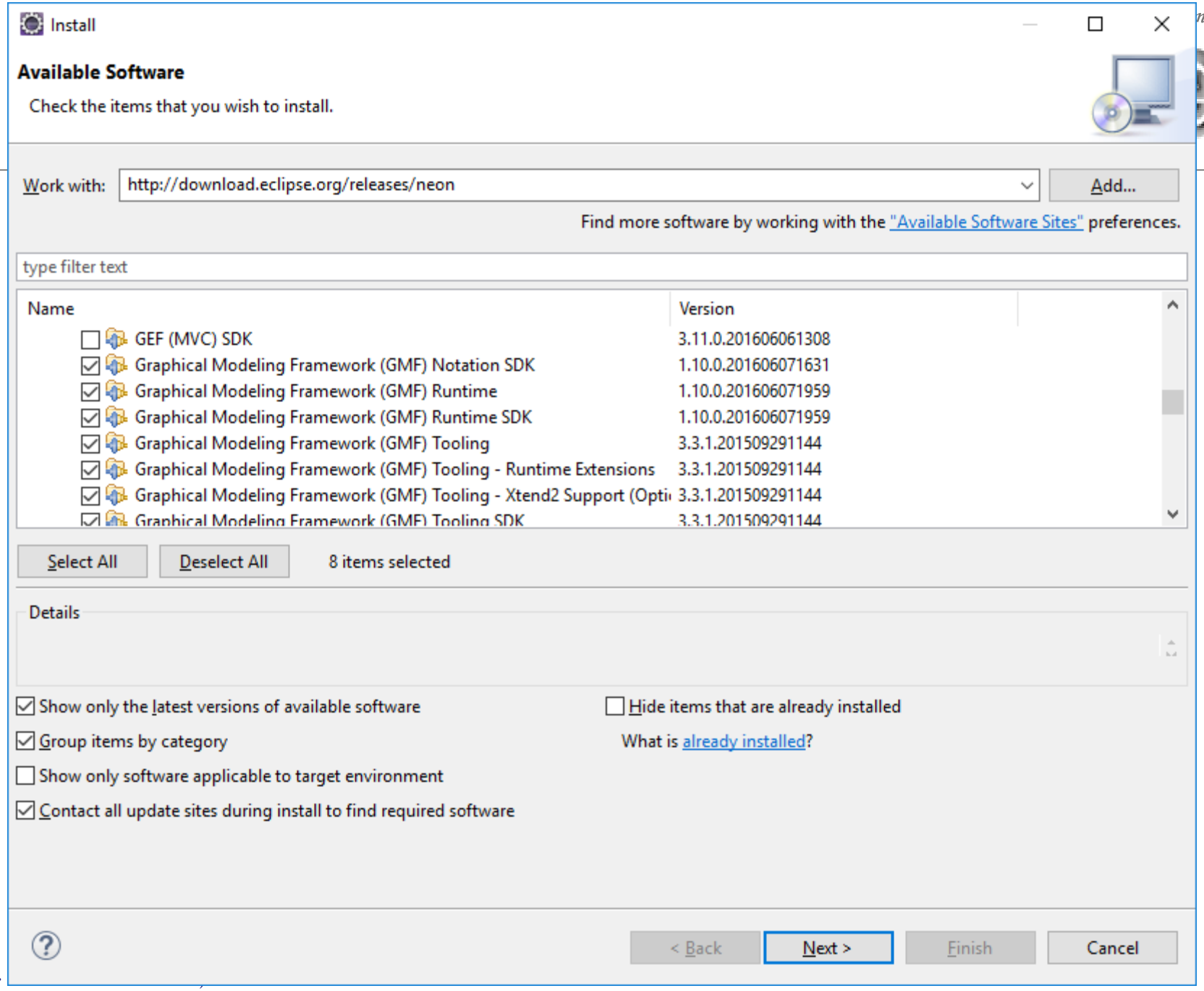
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GEF (MVC) SDK 3.11.0.201606061308
Graphical Modeling Framework (GMF) Notation SDK 1.10.0.201606071631
Graphical Modeling Framework (GMF) Runtime 1.10.0.201606071959
Graphical Modeling Framework (GMF) Runtime SDK 1.10.0.201606071959
Graphical Modeling Framework (GMF) Tooling 3.3.1.201509291144
Graphical Modeling Framework (GMF) Tooling - Runtime Extensions 3.3.1.201509291144
Graphical Modeling Framework (GMF) Tooling - Xtend2 Support (Opti 3.3.1.201509291144
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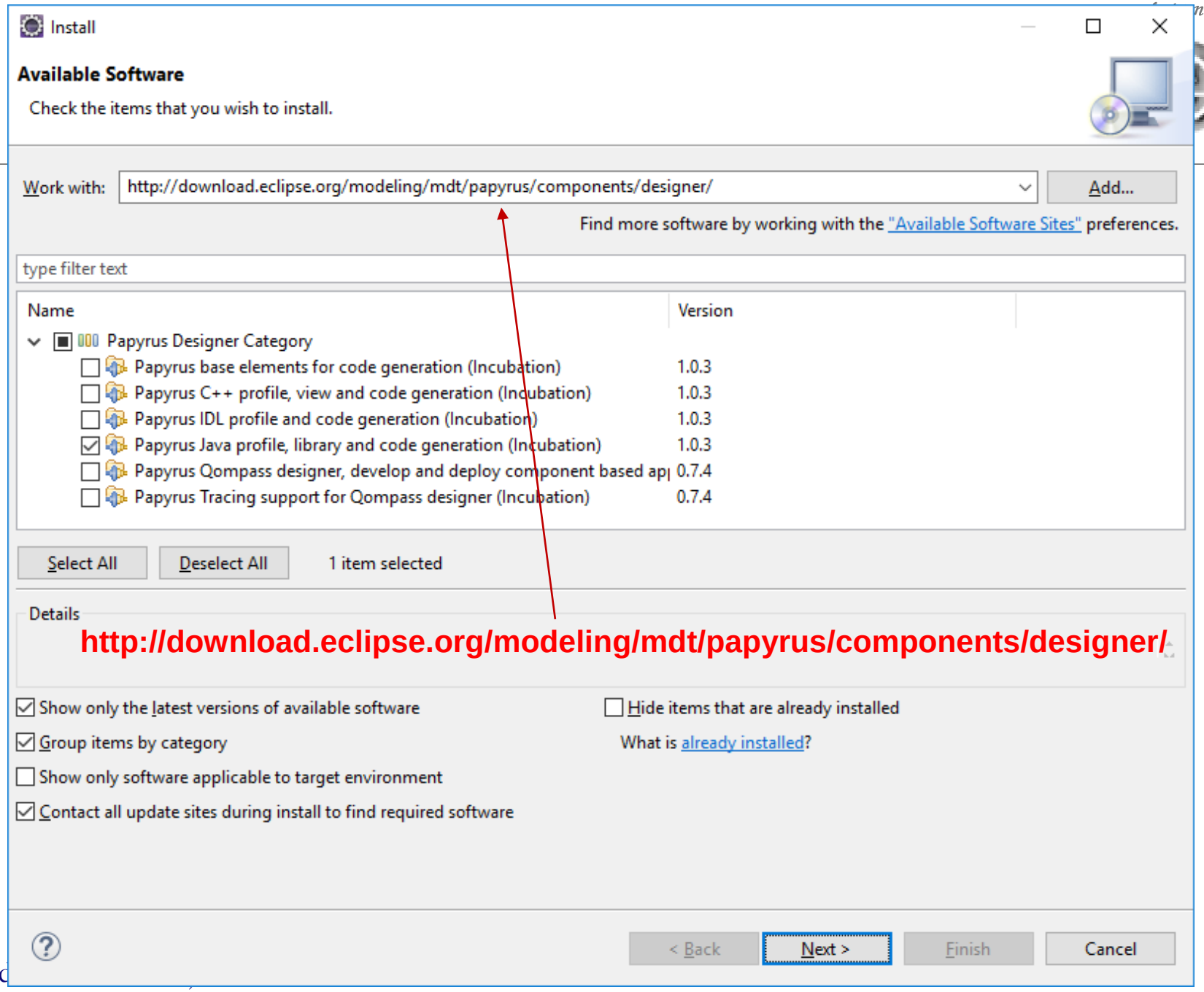
Generisanje Java koda

- **Kreiranje Java koda iz UML dijagrama klasa**
  - **Papyrus UML 2 plugin**
    - Uputstvo: https://milanardeshana.wordpress.com/2016/03/16/how-to-install-papyrus-and-generate-java-code-in-eclipse-mars-2/comment-page-1/
    - http://wiki.eclipse.org/Papyrus_User_Guide

Generisanje Java koda

- **Kreiranje Java koda iz UML dijagrama klasa**
  - **Papyrus Software Designer**
    - dodatni plugin nad Papyrus pluginom
    - Uputstvo: https://wiki.eclipse.org/Java_Code_Generation
    - Instalacioni plugin link: http://download.eclipse.org/modeling/mdt/papyrus/components/designer/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http://download.eclipse.org/modeling/mdt/papyrus/components/designer/
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ZADATAK

- Na osnovu teksta dobijenog zadatka (20p):
  - Izvršiti modeliranje pomoću UCM (5p) i GRL dijagrama (5p)
  - Izvršiti prevođenje UCM modela u UML UseCase dijagram i sekvencijalni dijagram (5p)
  - Nacrtati UML dijagram klasa i dijagram aktivnosti (5p)