Sequence Chart Studio
(SCStudio)

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Sequence Chart Studio

- provides verification and validation algorithms
- well arranged output

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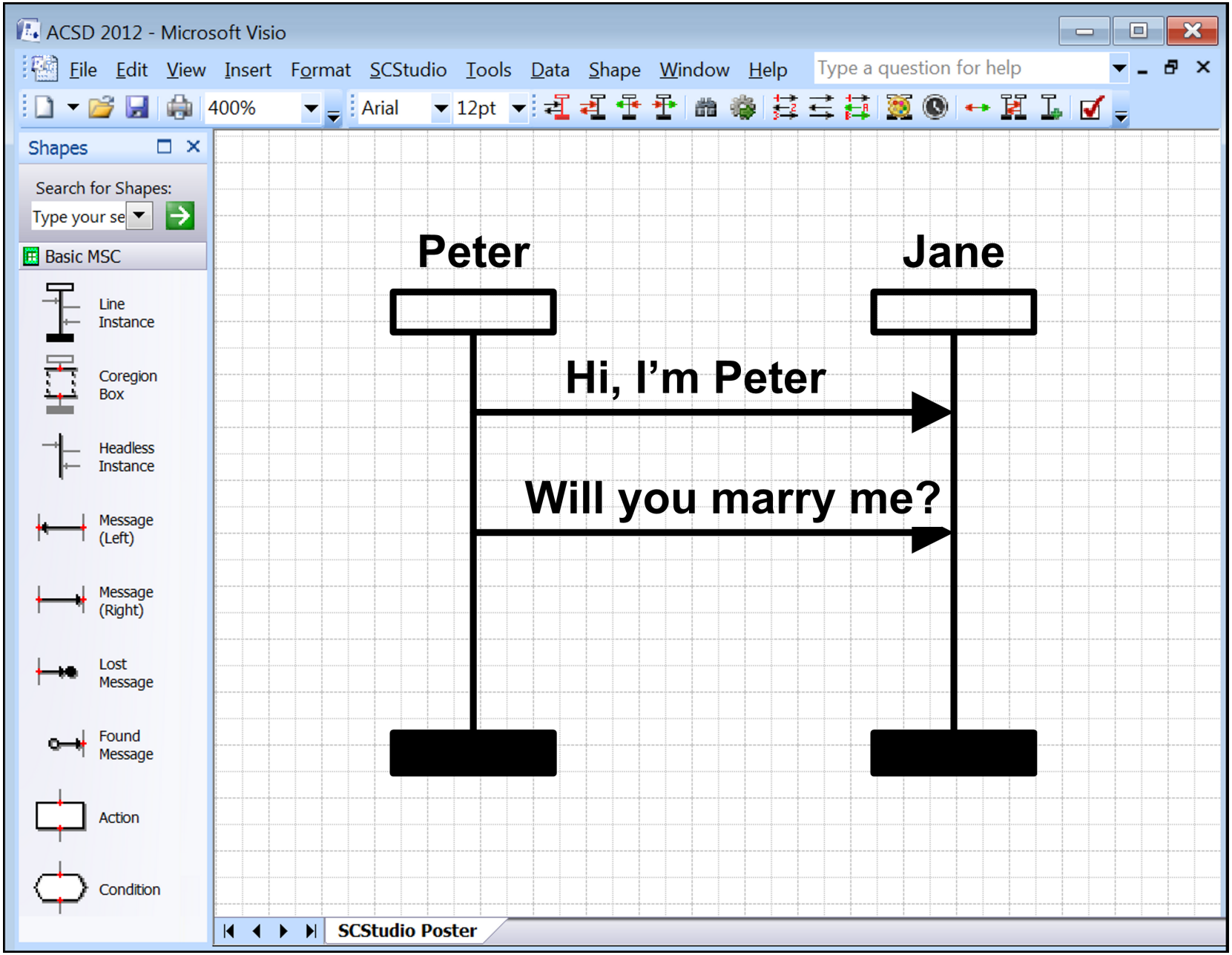
- well arranged output

- supports Message Sequence Chart (MSC) formalism
- open source verification tool (plug-in to Microsoft Visio)
- user-friendly graphical and textual interfaces

Graphical User Interface



Basic MSC

Basic Message Sequence Charts (BMSC) diagrams are used to describe a communication among instances.

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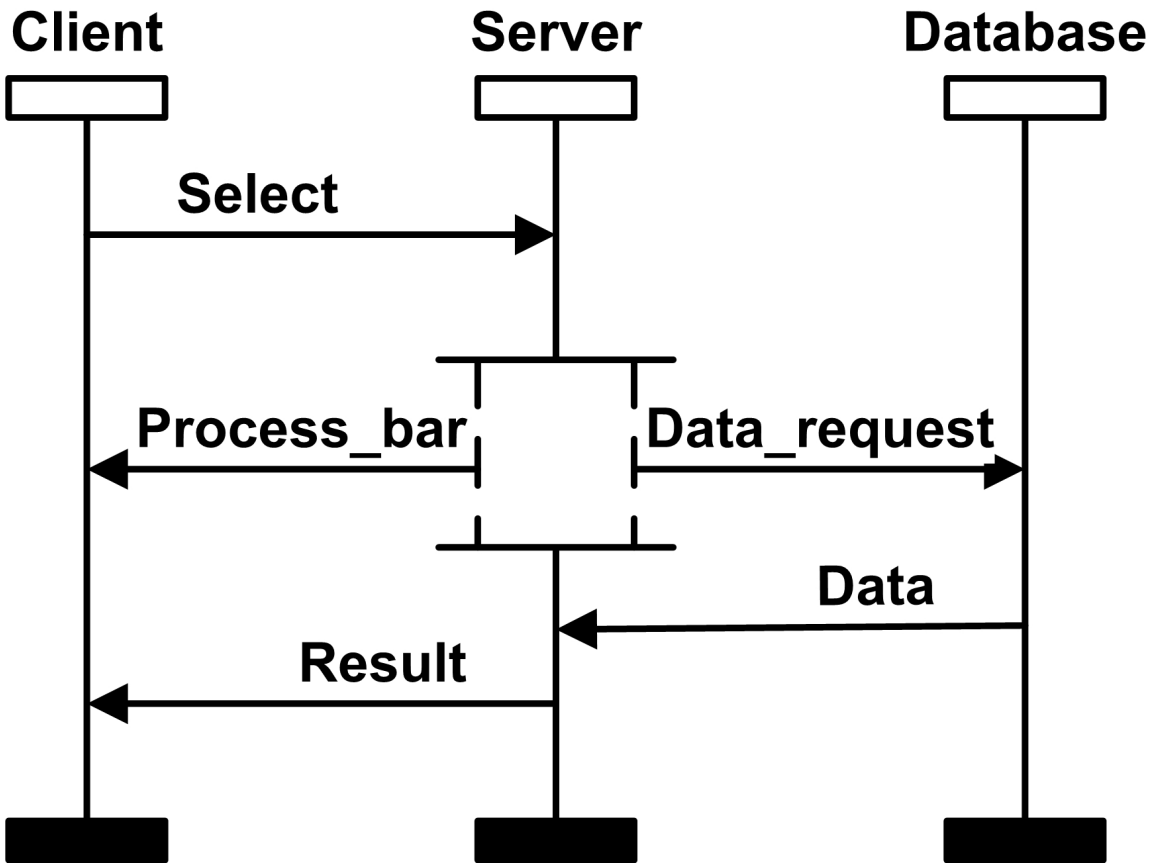
Instance – object which can communicate

Event – send or receive a message

Coregion – area without event ordering

BMSC Example



Obr.: BMSC

High-level MSC

High-level Message Sequence Charts (HMSC) diagrams are graphs which allow user to model a communication in hierarchical structure. HMSC with depth 1 is also called MSC graph.

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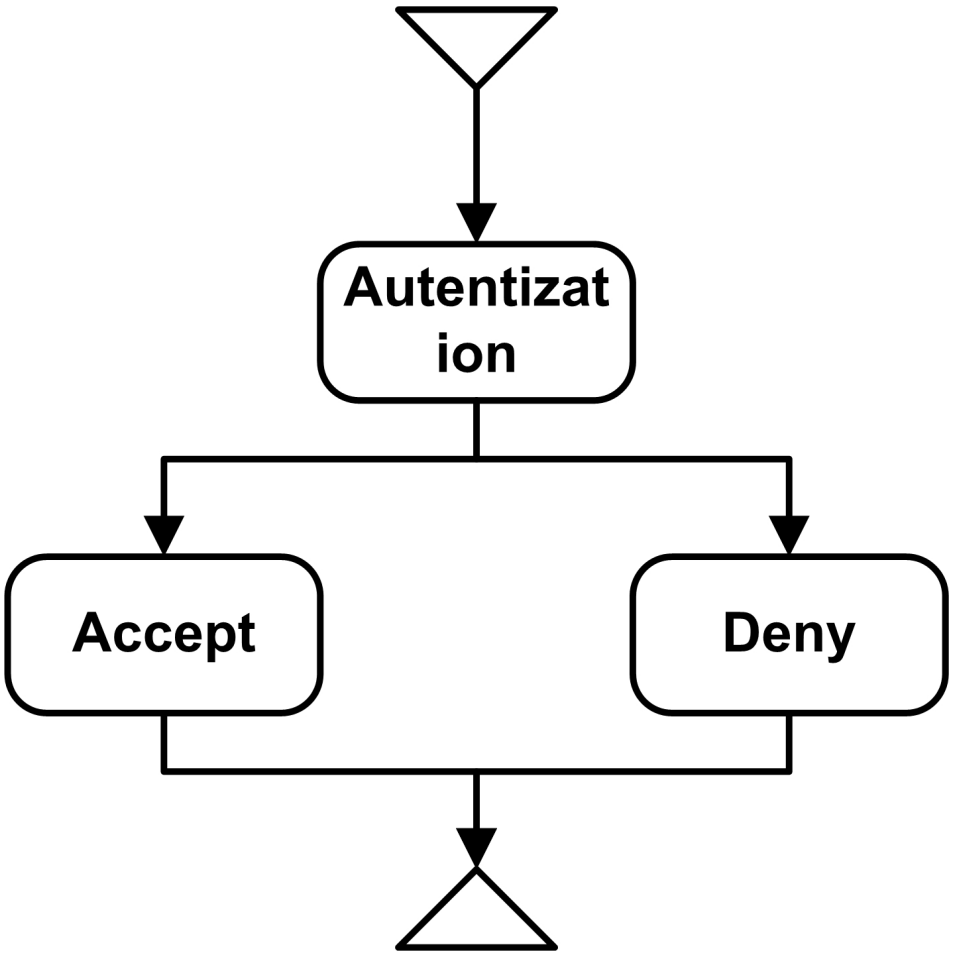
Start Node – beginning of the communication

Reference Node – high-level representation of some MSC diagram

End Node – ending of the communication

HMSC Example



Obr.: HMSC

Beautify Transformer

Beautify transformer redraws a diagram into well-arranged form.

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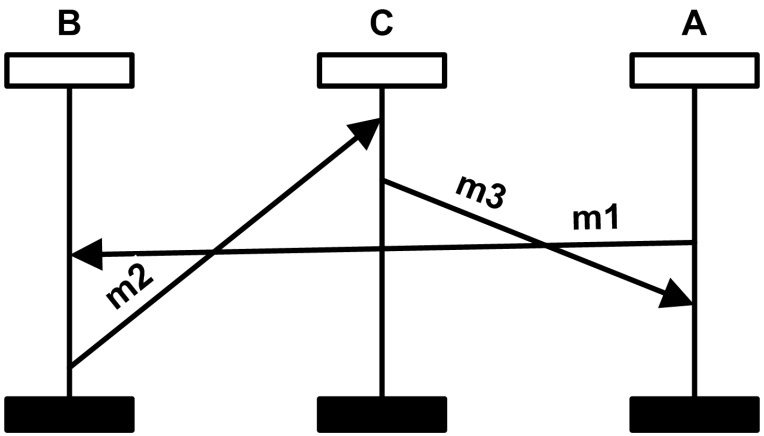

Non-well-arranged diagram

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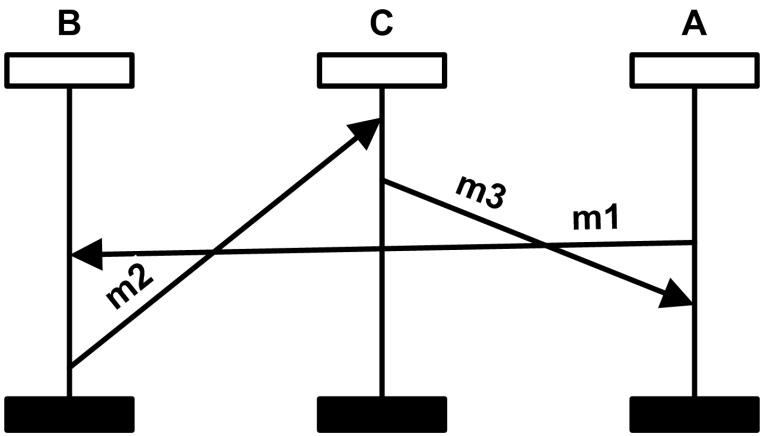

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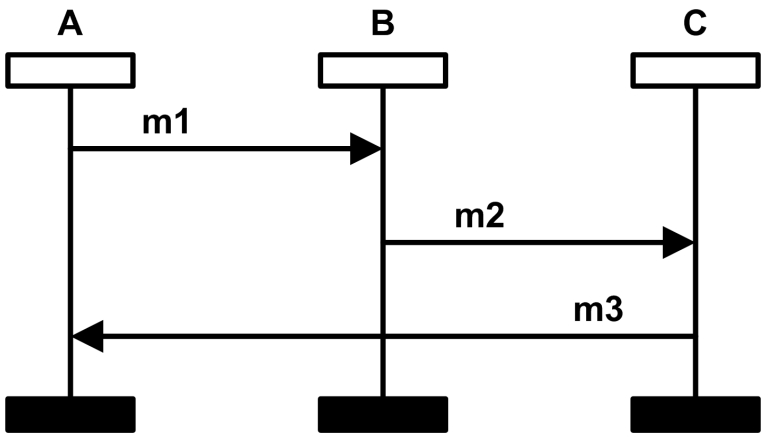
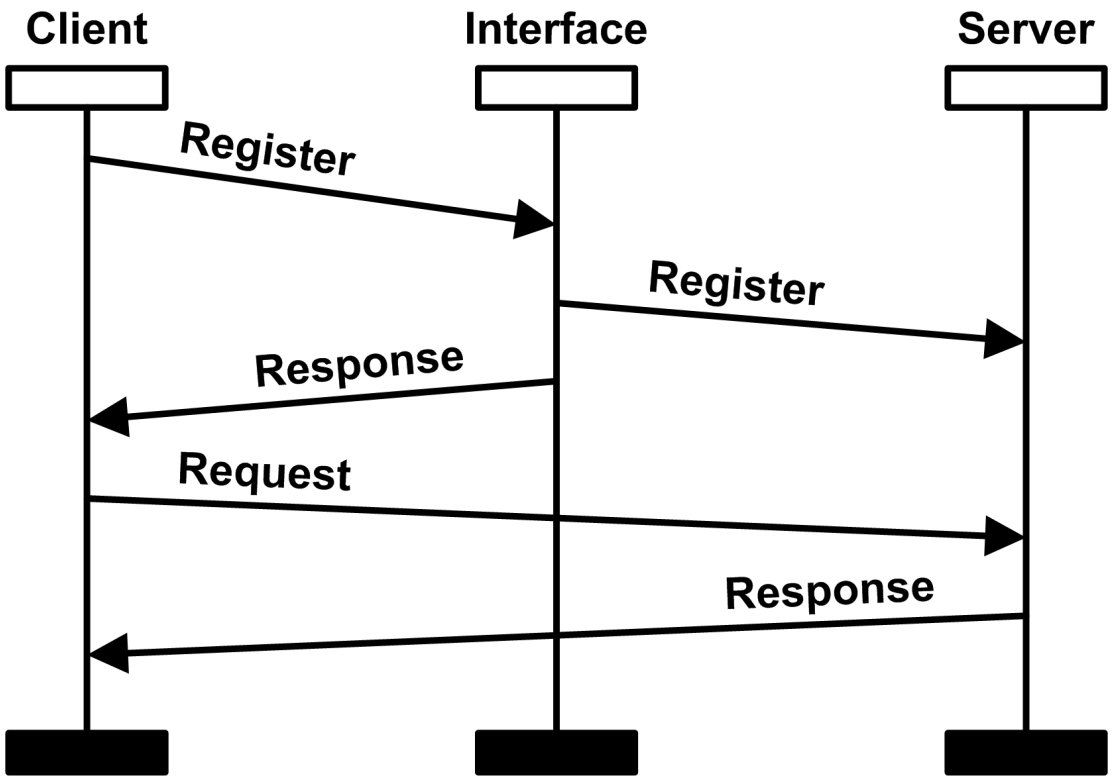


Well-arranged diagram

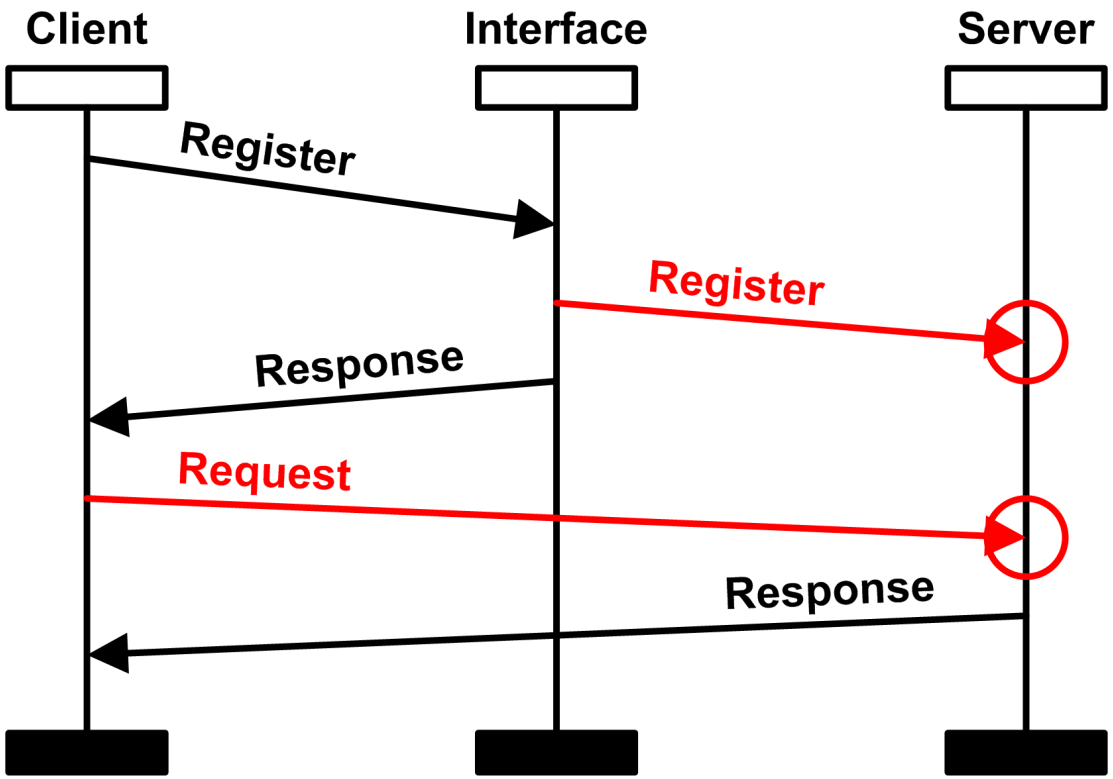
Protocol Design

Designers create a communication protocol:



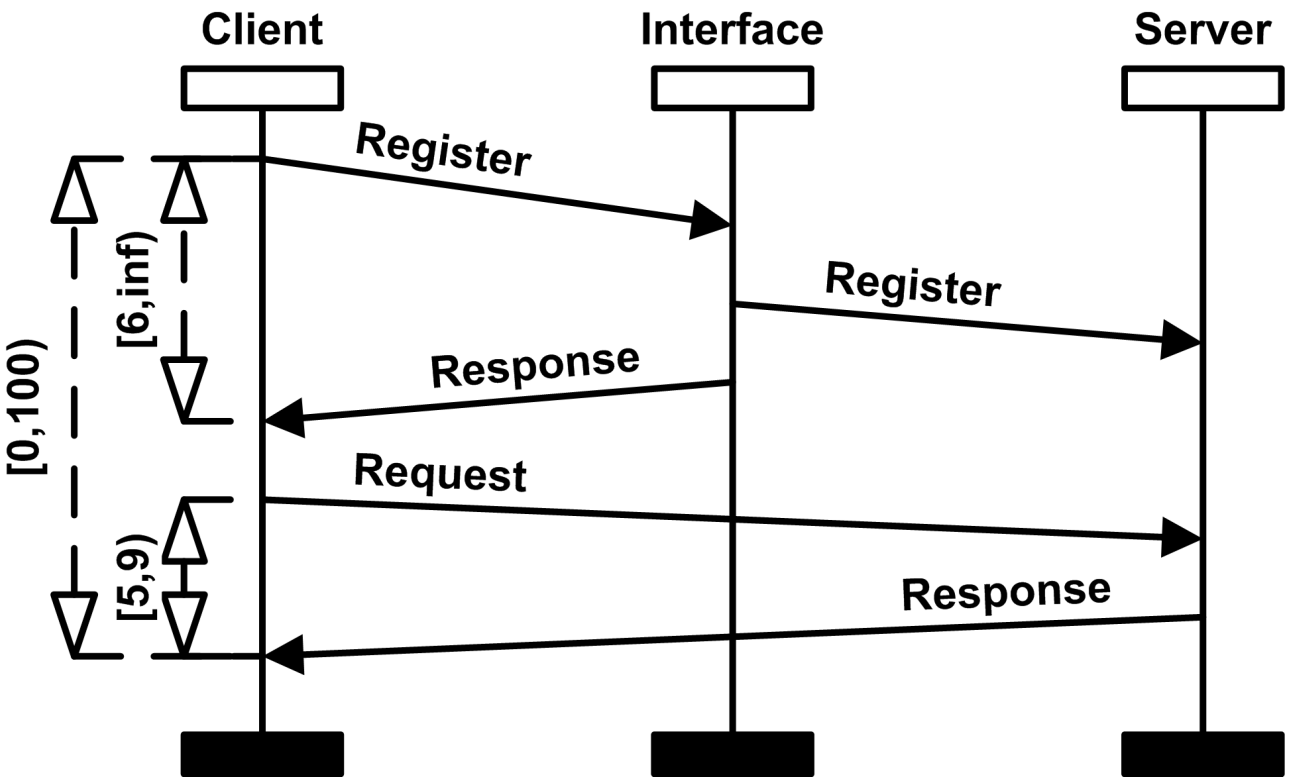
Protocol Verification

Verification tools identify a race condition problem.



Tighten Time

Tighten Time transformer restricts time intervals to minimal ranges



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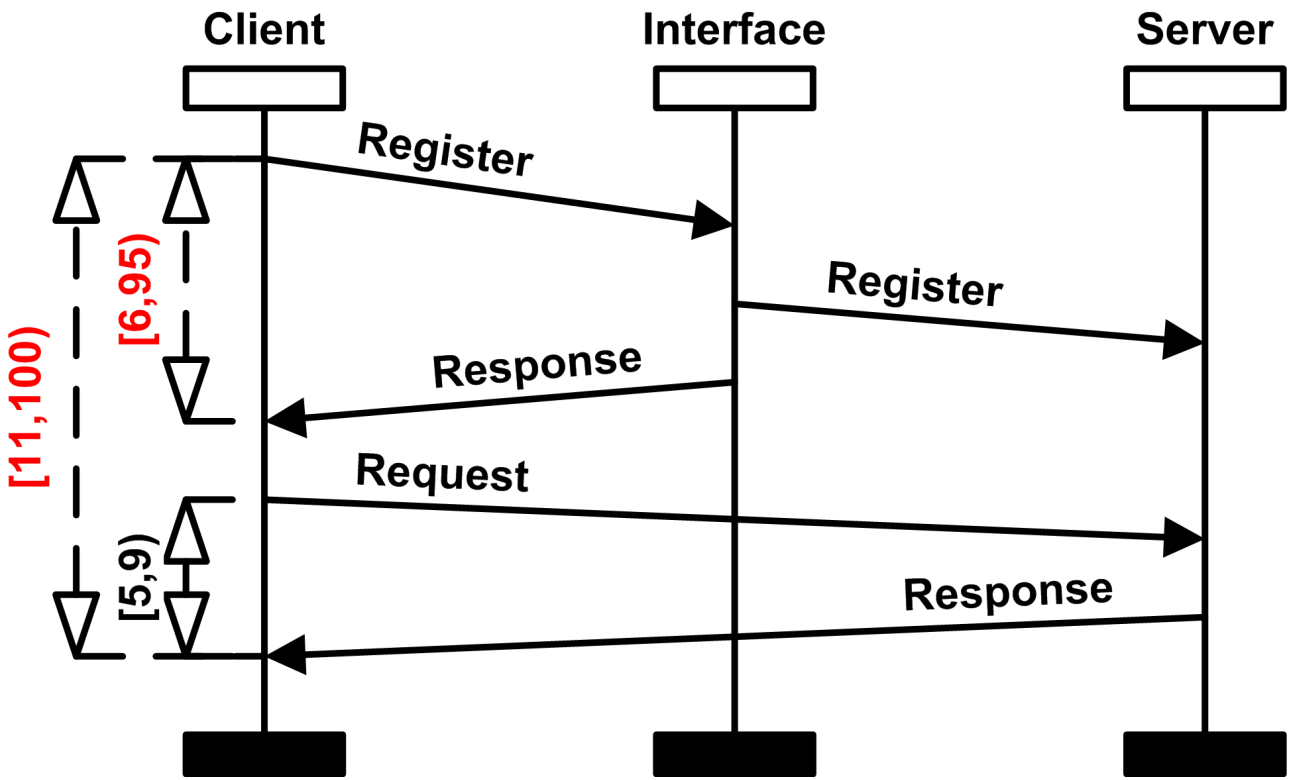
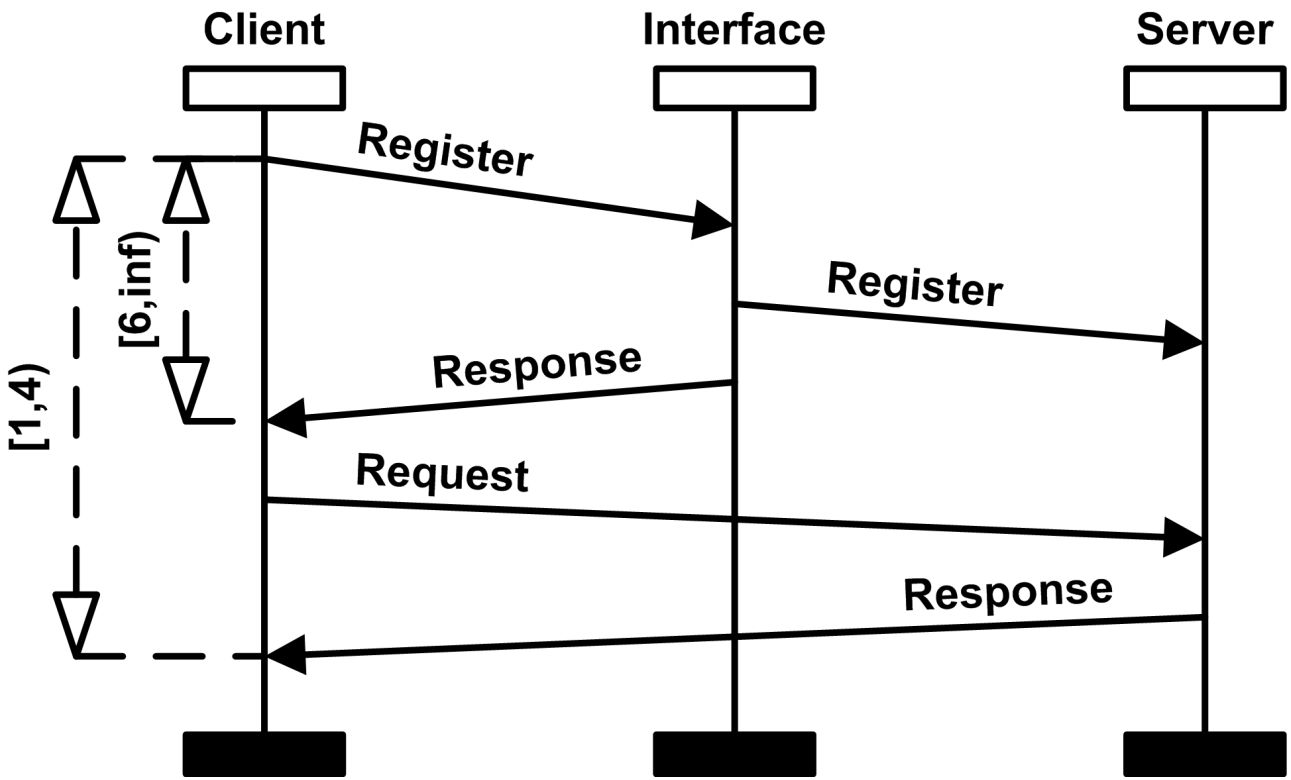


Time Consistency

Time Consistency checker finds intervals which are in a conflict with others



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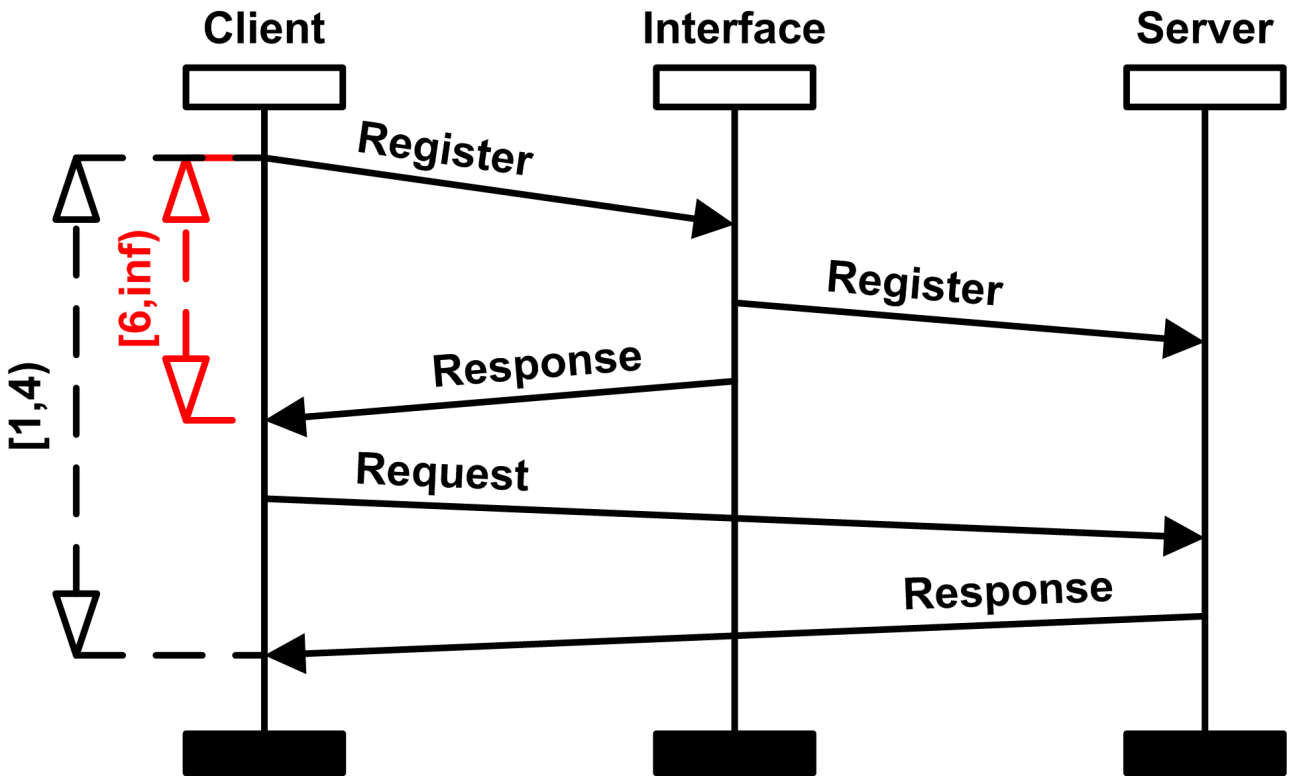
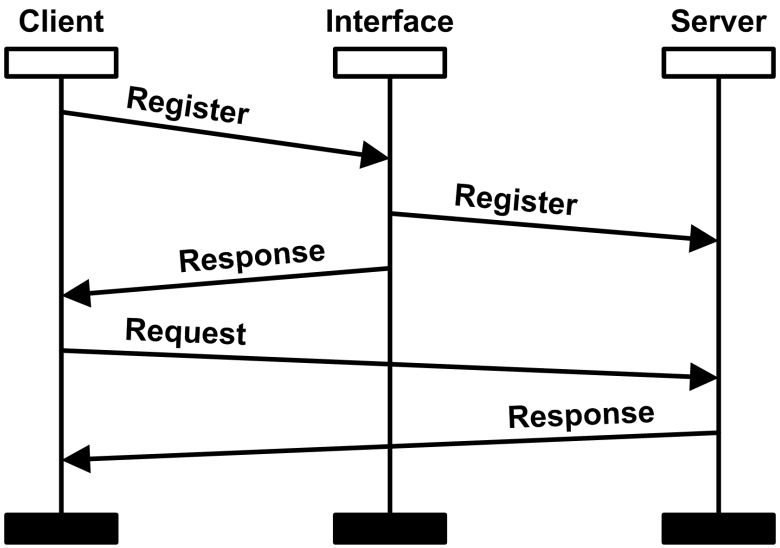


Find Flow

Find Flow function checks whether a basic MSC is contained in another MSC diagram.



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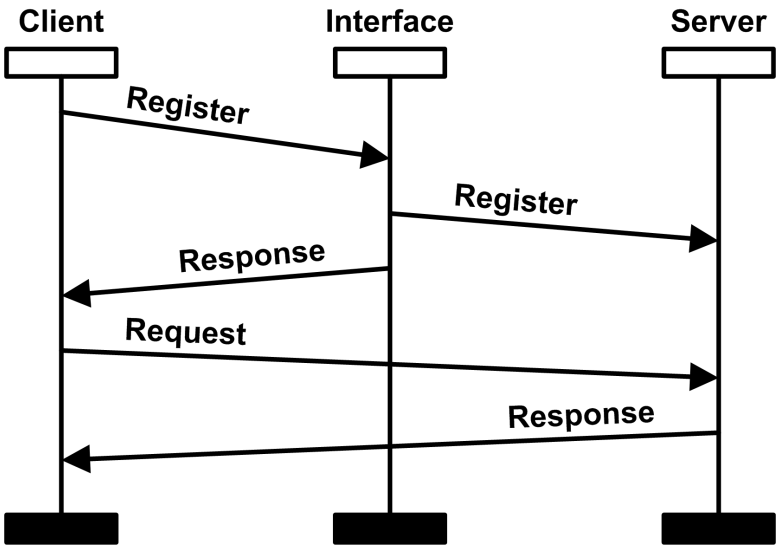

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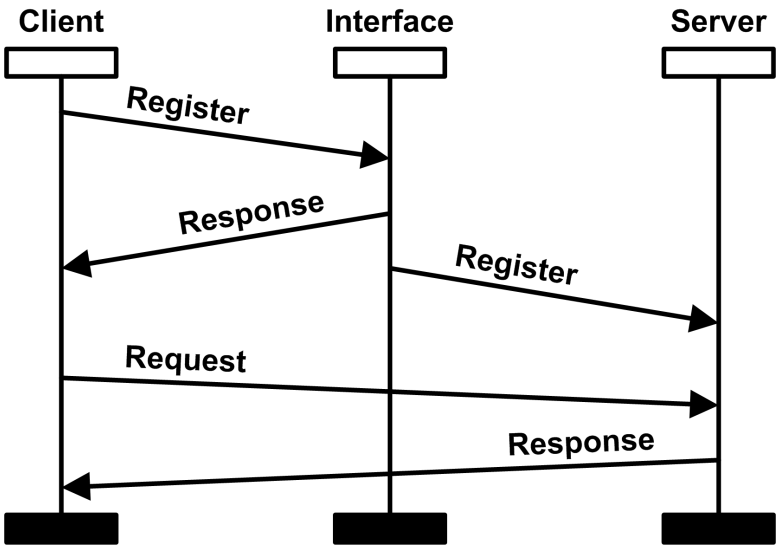

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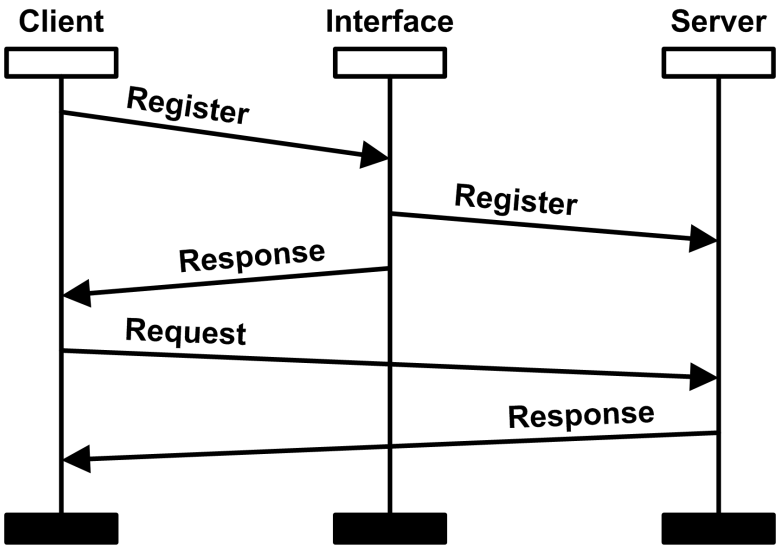

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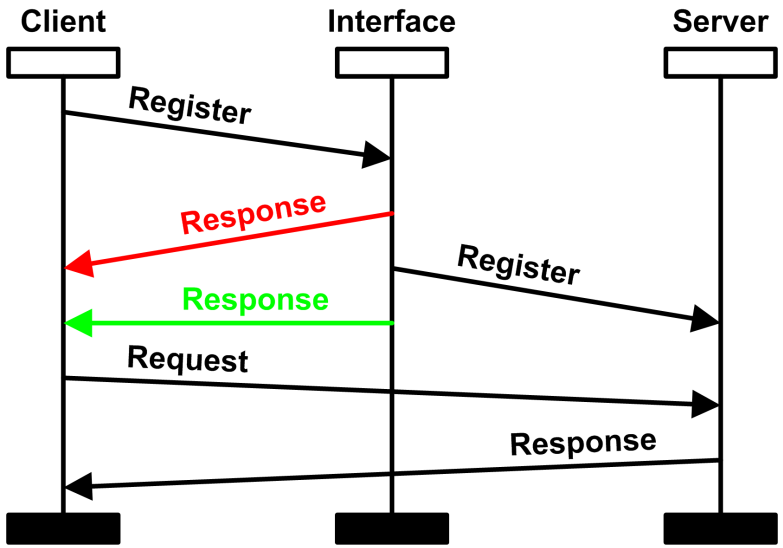

Find Flow result

Time Constraints in Find Flow

Find Flow supports

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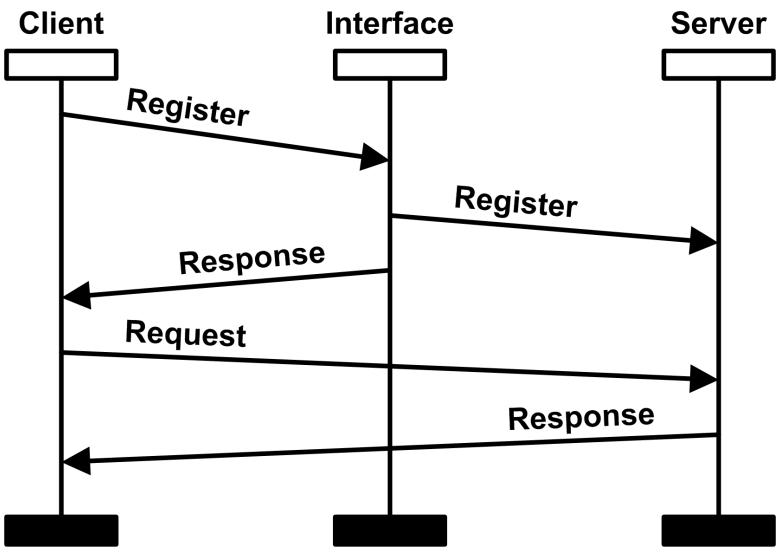

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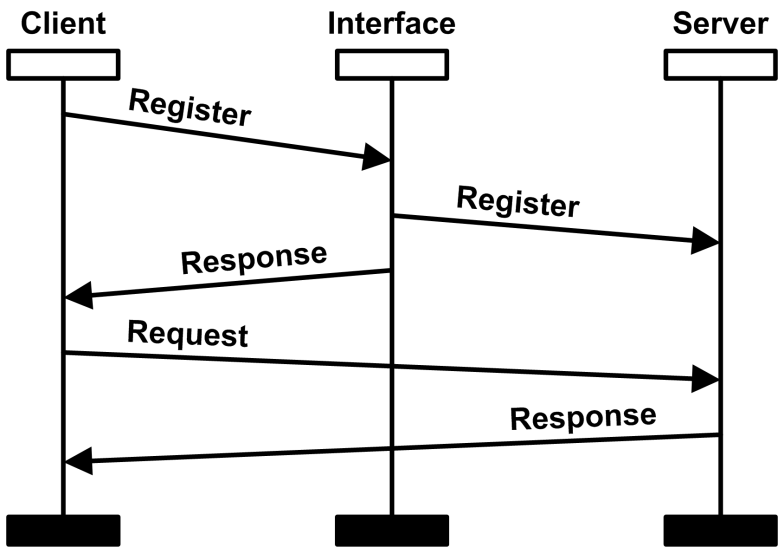

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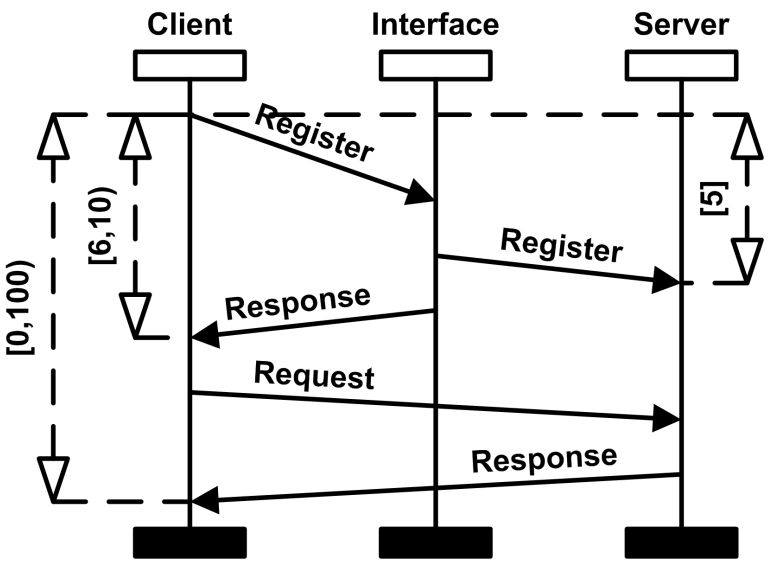

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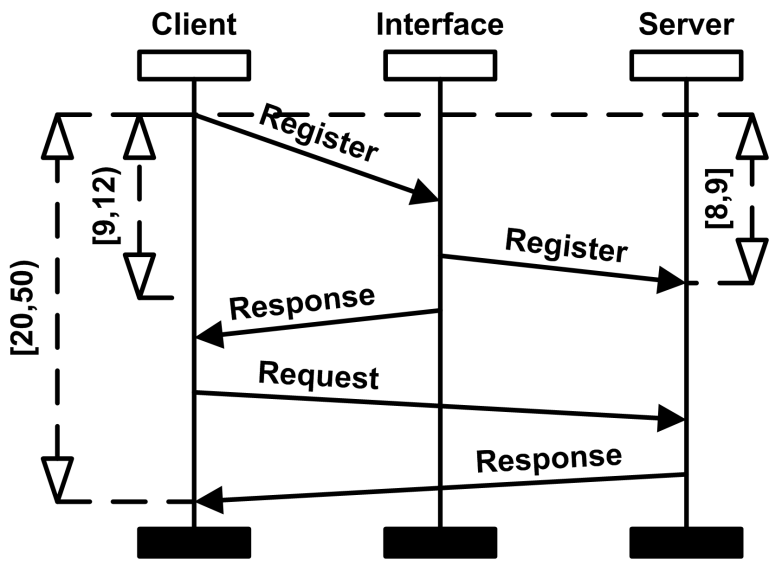

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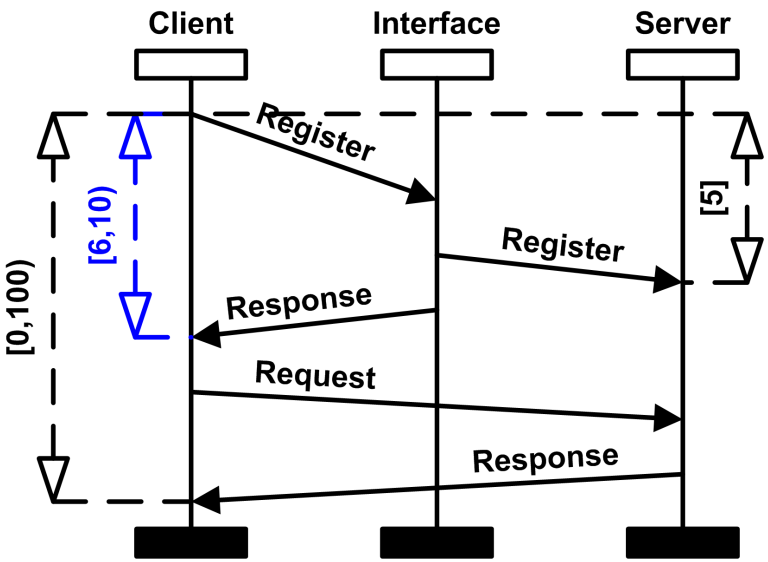

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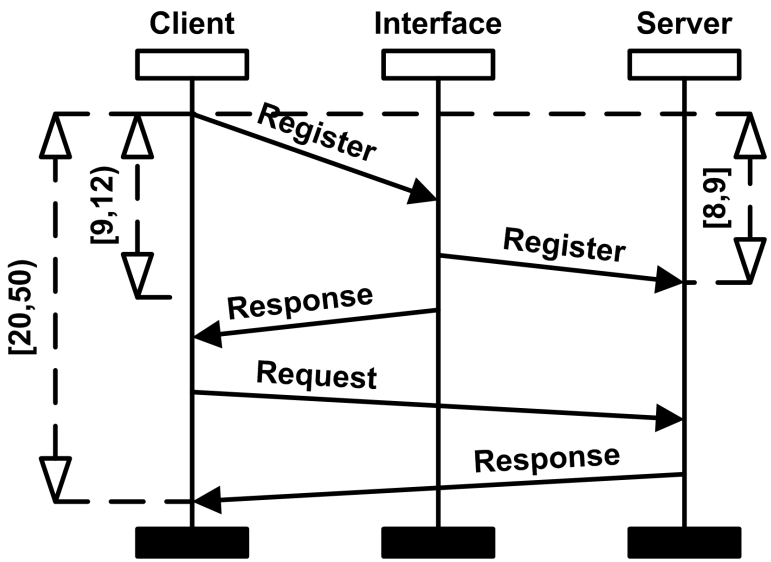

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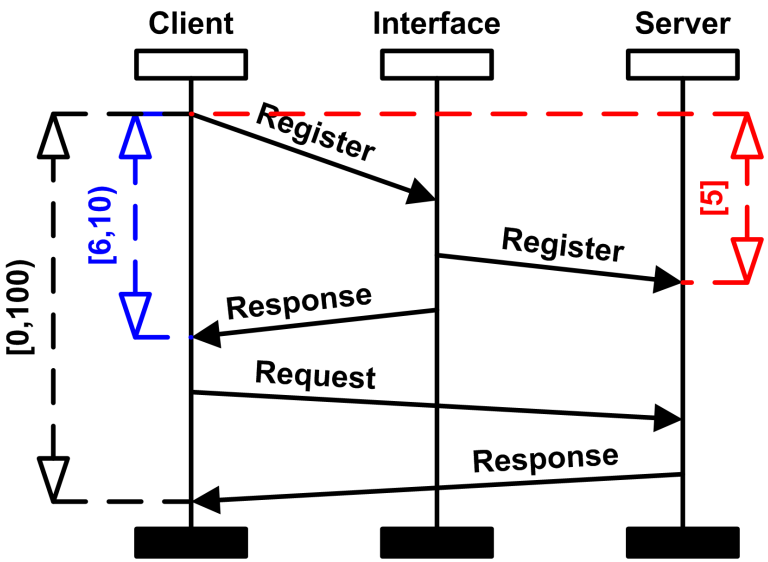

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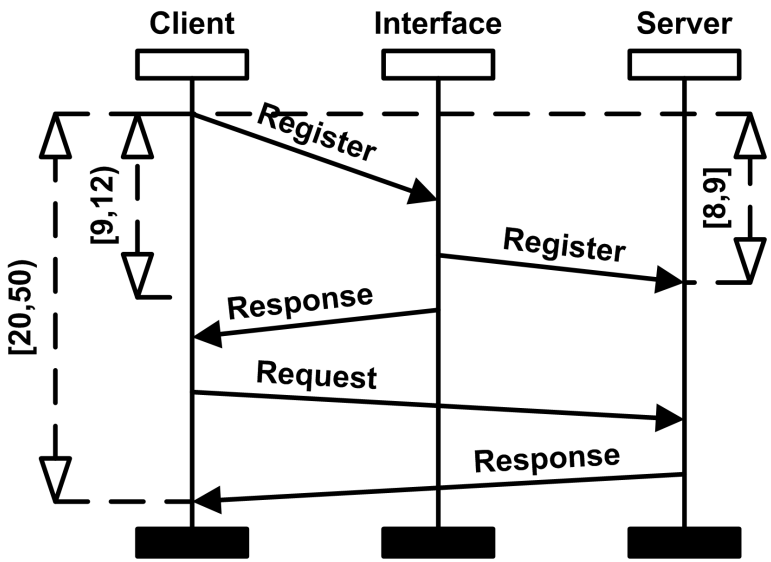

Flow

Summary

- **drawing aids**
  - easy and comfortable drawing
  - message flipping, shortcuts, ...
  - transformers Beautify, Tighten Time, ...
- **verification & validation tools**
  - (Time) Race checker
  - Time Consistency checker
  - Strong Realizability checker
- **additional functions**
  - Find Flow
  - Monte Carlo simulation (experimental)

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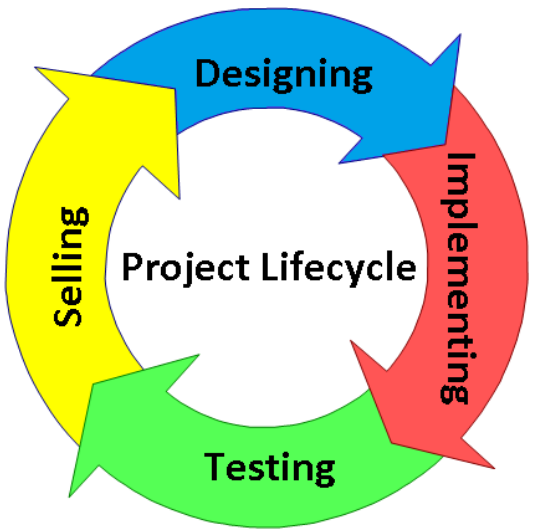

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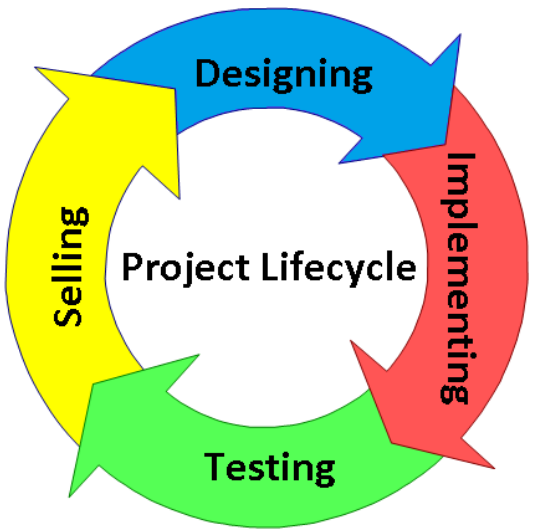

SCStudio is available on sourceforge.net

Happenings in last year

ANF DATA spol. s.r.o.

Siemens Convergence Creators, s.r.o.

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- **conference ACSD'12**

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- 1618 downloads last year (max 159 in one month)
- improved Find Flow
- **new students**

Students

- Export to TEX- bachelor
- Import PCAP - bachelor
- Time Order Visualization -bachelor
  - synchronize messages on instances by time stamps
- Models of Open IMS -master
  - create formal models of Open IMS system (MSCs, Petri nets)

Export to TEX

Existed exports:

- textual form of ITU-T standard
- DiVinE (LTL model checking tool)

Target:

- express diagrams in TEX source code

Motivation:

- comfortable diagram's usage in presentations

Assignment

Requirements

- TEX source code for exact visualization from MS Visio
- readable & editable code

MSC.sty

- does not support all objects
- weak support of object settings

My Work

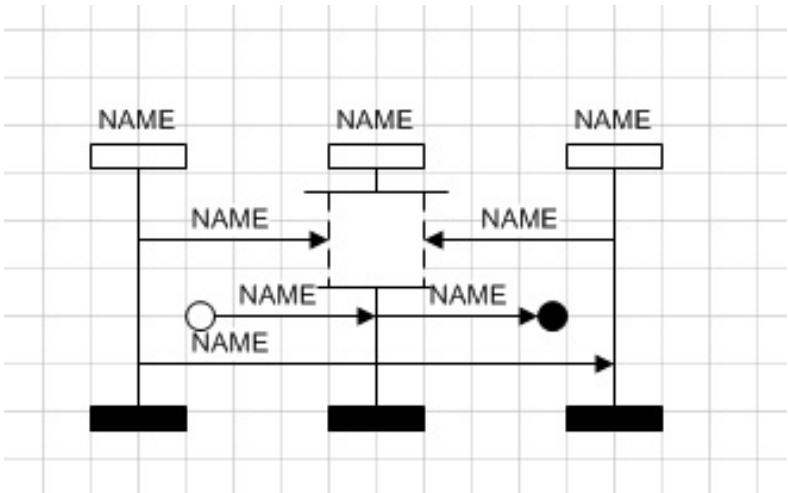
Necessary to add:

- objects: orders, comments ...
- object properties

Additional targets:

- colors
- upload new library to CTAN

Example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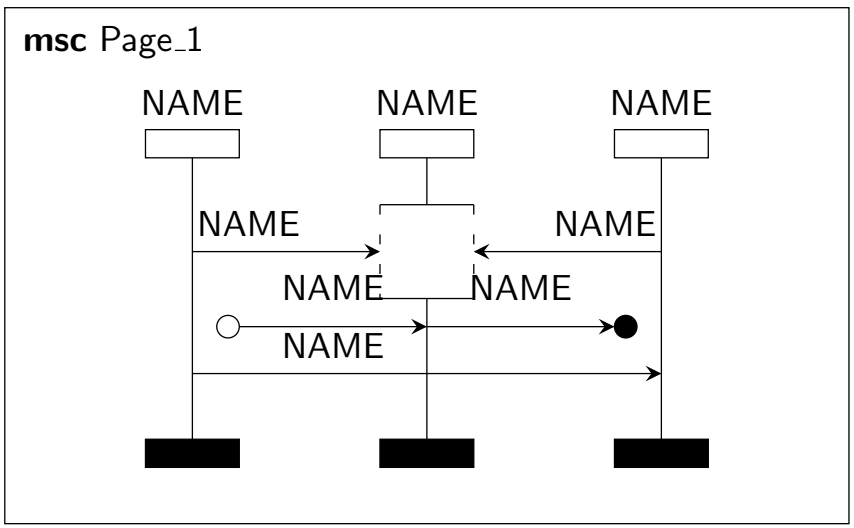
msc Page_1
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Source Code Example

```
%%%% Scale Y
\def\scale@y{1.0}

%%%% Instance first and last level height
\setlength{\firstlevelheight}{10mm*\real{\scale@y}}
\setlength{\lastlevelheight}{10mm*\real{\scale@y}}

%%%% Levels:
\def\levela{10mm*\real{\scale@y}}
\def\levelb{5mm*\real{\scale@y}}

%%%% Slope:
\def\slopea{3mm*\real{\scale@y}}
\def\slopeb{\levela+\levelb}

%%%% Instance width:
\def\instanceWidtha{10mm*\real{\scale@y}}
```

PCAP Import

Existed imports:

- textual form of ITU-T standard

Target:

- transform network traffic from pcap files and visualize them as MSC diagrams

Motivation:

- compare traffic flows with protocol design diagrams by Find Flow algorithm

Time Order Visualization

Existed visualization:

- small layout assigned according ITU-T standard

Target:

- visualization with synchronize time clocks on instances

Motivation:

- asked by users, specially for network traffic visualization

Models of Open IMS

Target:

- create formal models of Open IMS system focused on SIP protocol

Motivation:

- detailed analysis helps us to apply SCStudio in real project development

Future Work

Extend Find Flow to be usable on PCAP files in real networks and cooperation with Siemens.

Targets in test area:

- cover of high-level diagram
- test case generation

Targets in user interaction:

- GUI for Linux
- improve MS Visio plug-in

Looking for students

Theses

- Find Flow (2 - 3 bachelor students)
- MS Visio stencils (1 student)
- Extend ITU-T standard (1 bachelor student)
- Libre Office plug-in (probably 1 student)
- Formal verification of SCStudio (probably 1 student)
- Local Choice decidability (1 master student)

Thank you for your attention

scstudio.sourceforge.net

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ