



# Model Based Development on a Command & Control System

## A Case Study by STM and IBM

Bora UYSAL  
Senior Software Engineer, STM  
[buysal@stm.com.tr](mailto:buysal@stm.com.tr)

Cem GÜNDÜZ  
Senior Software Engineer, STM  
[cgrunduz@stm.com.tr](mailto:cgrunduz@stm.com.tr)

Serkan GÜLENCİ  
Senior Software Engineer, STM  
[sgulenc@stm.com.tr](mailto:sgulenc@stm.com.tr)

Kerim ÇAKMAK  
Rational Technical Sales, IBM  
[kerimc@tr.ibm.com](mailto:kerimc@tr.ibm.com)

IBM Software

# Innovate2012

The Premier Event for Software and Systems Innovation



## Overview

- STM Overview
- Case Study
- Objectives & Road Map
- Architecture of the Solution
- IBM Rhapsody - Nokia Qt Integration
- Benefits of using IBM Rational Rhapsody



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## STM Overview

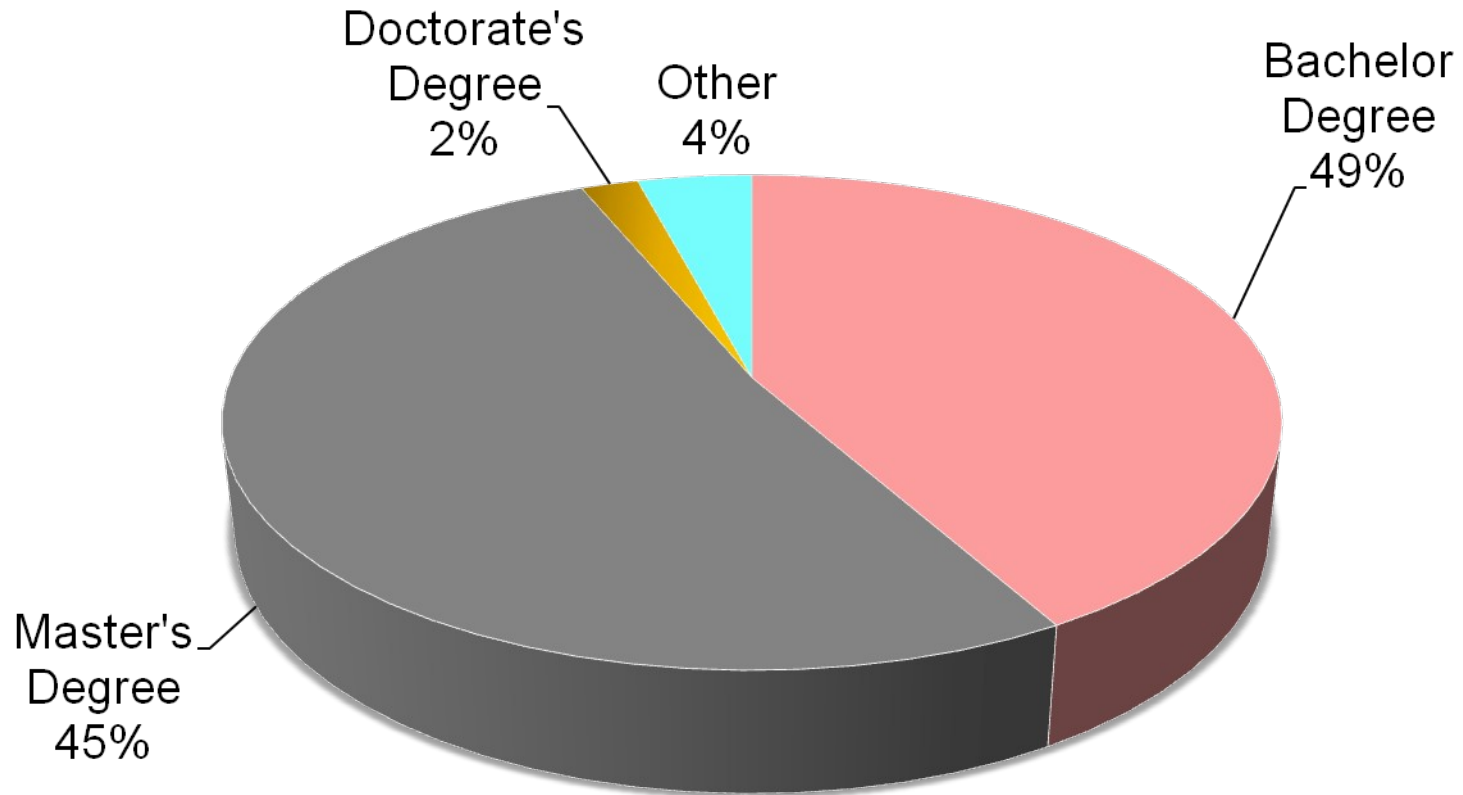
STM was established in 1991 by the decree of the Defence Industry Executive Committee, highest decision making authority in Turkey, for the following purposes:

- To provide technical support, systems engineering, project management, technology transfer and logistics support services to TAF (Turkish Armed Forces) and SSM (Undersecretariat for Defence Industries)
- To develop necessary software technologies for defence systems, and to establish and operate national software centers for software development and maintenance/support.

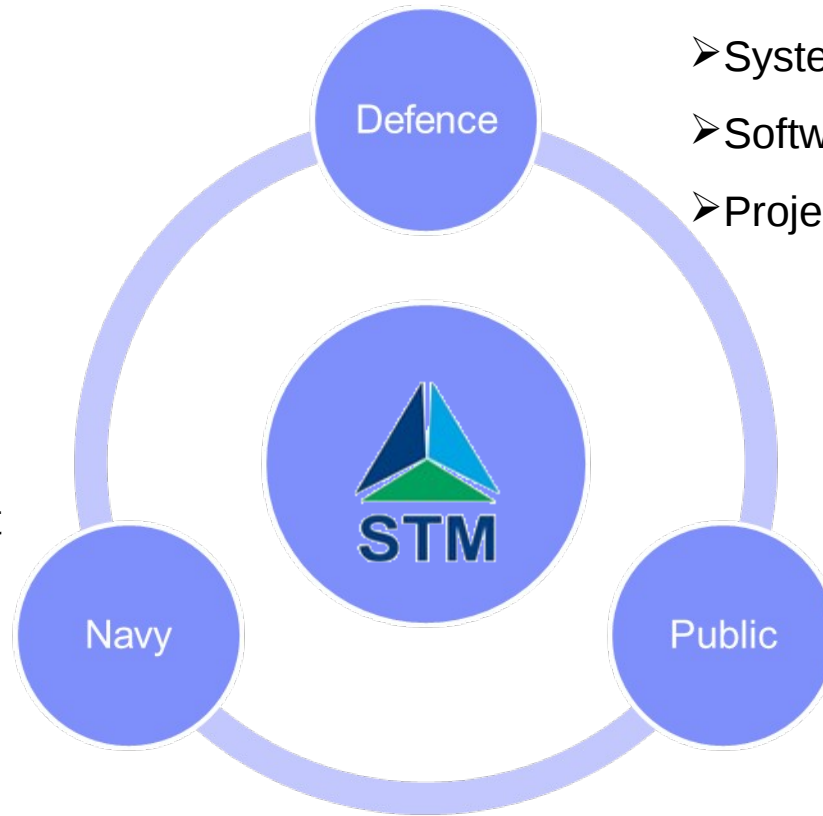
## Company Profile

Total number of employees: 385

93% (361) of STM employees are of BSc and MSc Degree.



## Business Areas



- Consultancy Services
- Systems Engineering
- Software Engineering
- Project Management

- Project Management
- Design, Integration, Tests and Trials
- Modernization
- Systems Engineering
- Shipyard Layout Organization & Management

- Consultancy Services
- Quality
- Acquisition Projects
- Logistics

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# Case Study

**Battalion Command  
Post Computer**



**Vehicle Command  
Control Computer**



**Preparation  
Computer**





# Tank Command Control Communication and Information System



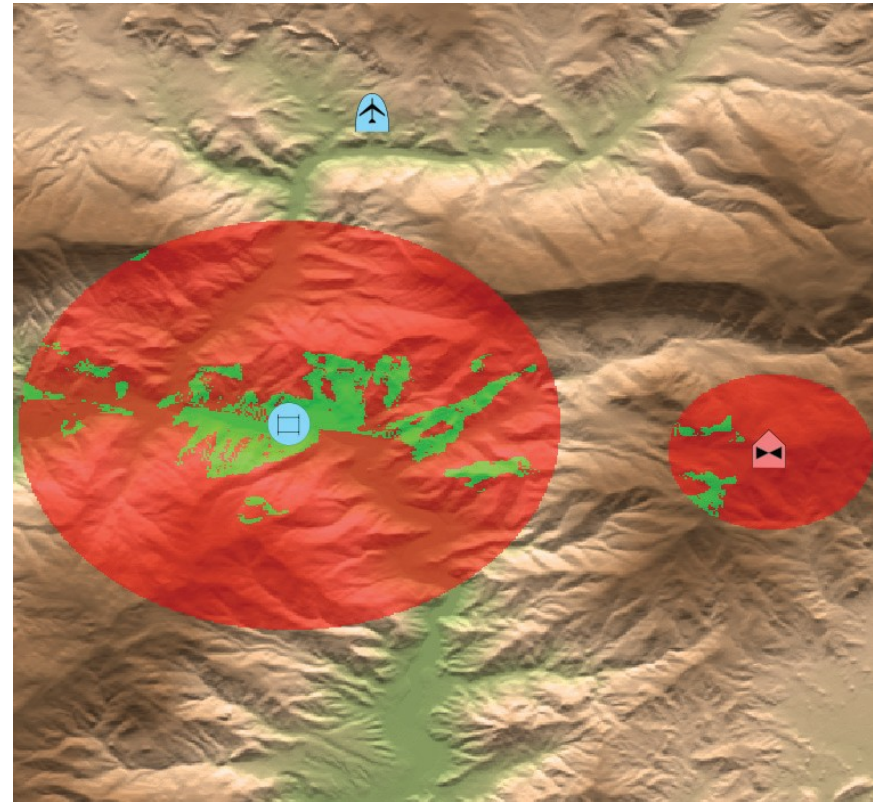
## Situational Awareness & Exchange of Reports

- Friendly Force Tracking
- Hostile / Unknown / Neutral Units
- Obstacles (Minefield, Anti-tank ditch, etc.)
- CBRN (Chemical, Biological, Radiological, Nuclear)
- Supply Points
- Bridges
- Alerts (Air Assault, Artillery Fire, etc.)



## Mission Planning & GIS (Geographical Information System)

- Raster, Shaded, Vector map display
- Multiple layer support (raster, shaded, units, route, etc.)
- Multiple geocoordinate system support (MGRS-Military Grid Reference System, UTM-Universal Transverse Mercator, Geographical)
- Overlays, Route Planning
- Mission Record & Replay



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## Objectives

- Platform independency
- Agility and responsiveness to change
- Reusable components
- Simplify and speed up development
- Lower the required skill level needed to work
- Complete solution throughout development lifecycle



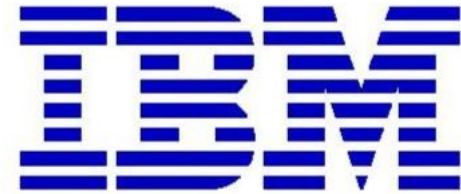
## Complete Solution

- IBM Doors for Requirement Analysis
- IBM Gateway for requirements traceability

solution that links to development

- IBM Reporter Plus for documentation

- *IBM Rhapsody for Design and Development*



# IBM Doors for Requirement Analysis



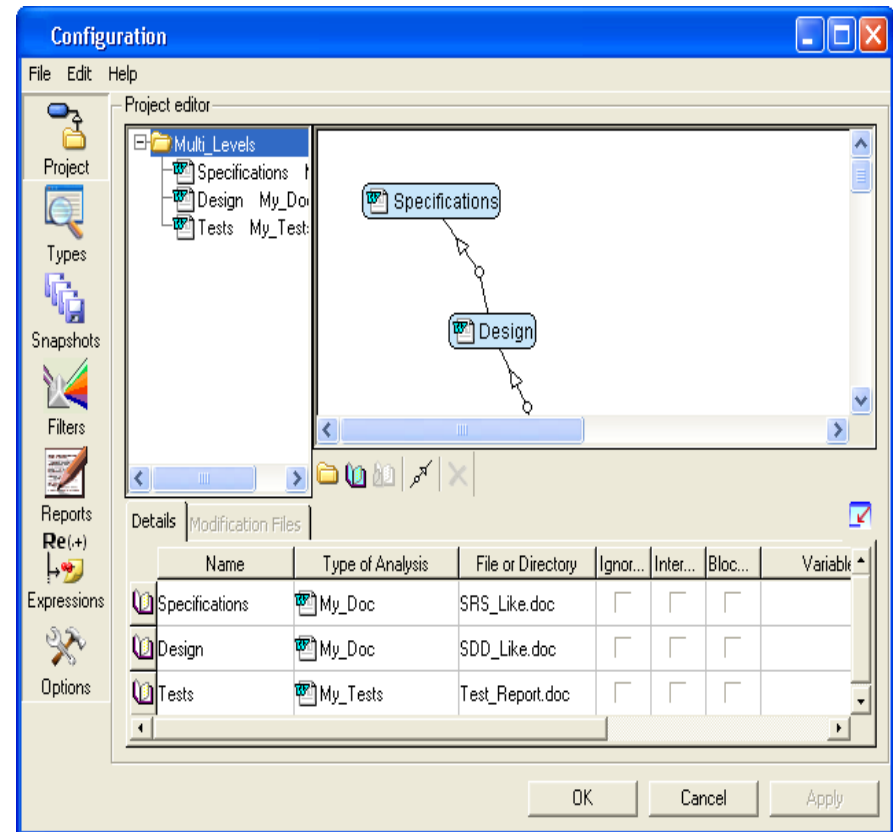
- System Requirement Management
- Software Requirement Management
- Traceability between Software and System Requirements
- Traceability between System Requirements and Test Scenarios

The screenshot shows the IBM Doors software interface. On the left is a tree view of requirements. The main area displays a table with the following data:

ID	Requirements created in DOORS	Test Cases	Test Status
1	<b>1 Requirement 1</b>		Not Approved
14	<b>1.1 Requirement 1A</b> Requirement 1a details	(2) TC2: Failed	Not Approved
15	<b>1.2 Requirement 1B</b> Requirement 1b details -modified	(2) TC2: Failed	Not Approved
2	<b>2 Requirement 2</b> Requirement 2 details	(1) TC1: Passed (2) TC2: Failed	Not Approved
3	<b>3 Requirement 3</b>		Not Approved
16	<b>3.1 Requirement 3a</b> Requirement 3a details	(2) TC2: Failed	Not Approved
17	<b>3.2 Requirement 3b</b> Requirement 3b details	(2) TC2: Failed	Not Approved
18	<b>3.3 Requirement 3c</b> Requirement 3c details	(2) TC2: Failed	Not Approved
4	<b>4 Requirement 4</b> Requirement 4 details	(2) TC2: Failed	Not Approved
5	<b>5 Requirement 5</b> Requirement 5 details	(1) TC1: Passed (2) TC2: Failed	Not Approved
6	<b>6 Requirement 6</b>	(2) TC2: Failed	Not Approved

# Rational Rhapsody Gateway and ReporterPLUS

- Traceability between the software requirements and design
- Coverage Analysis
- Customizable Architectural and Detailed Design Documentation

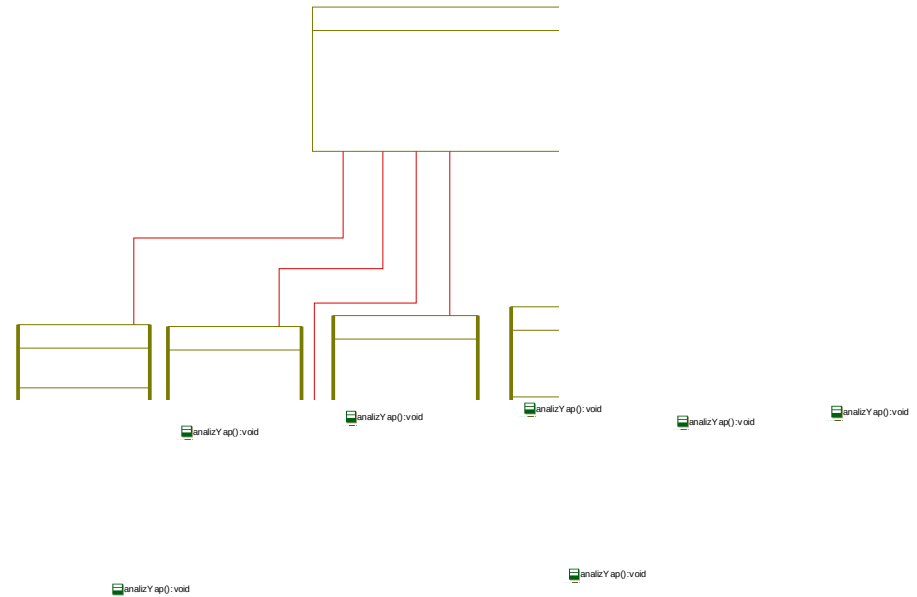




# IBM Rhapsody for Design and Development



- Software Architectural Design
- Software Detailed Design
- Software Development



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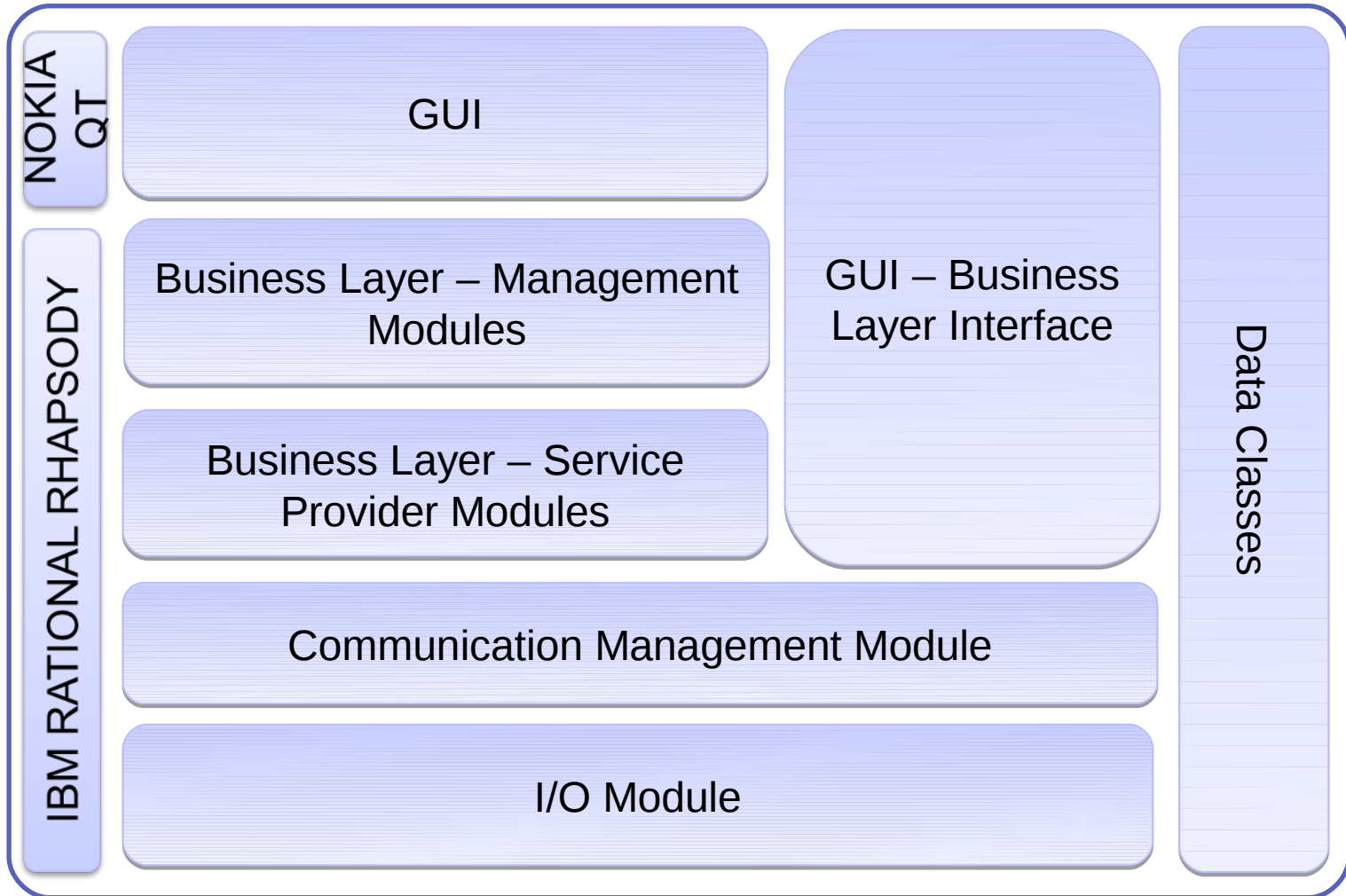


## Architecture of the Solution

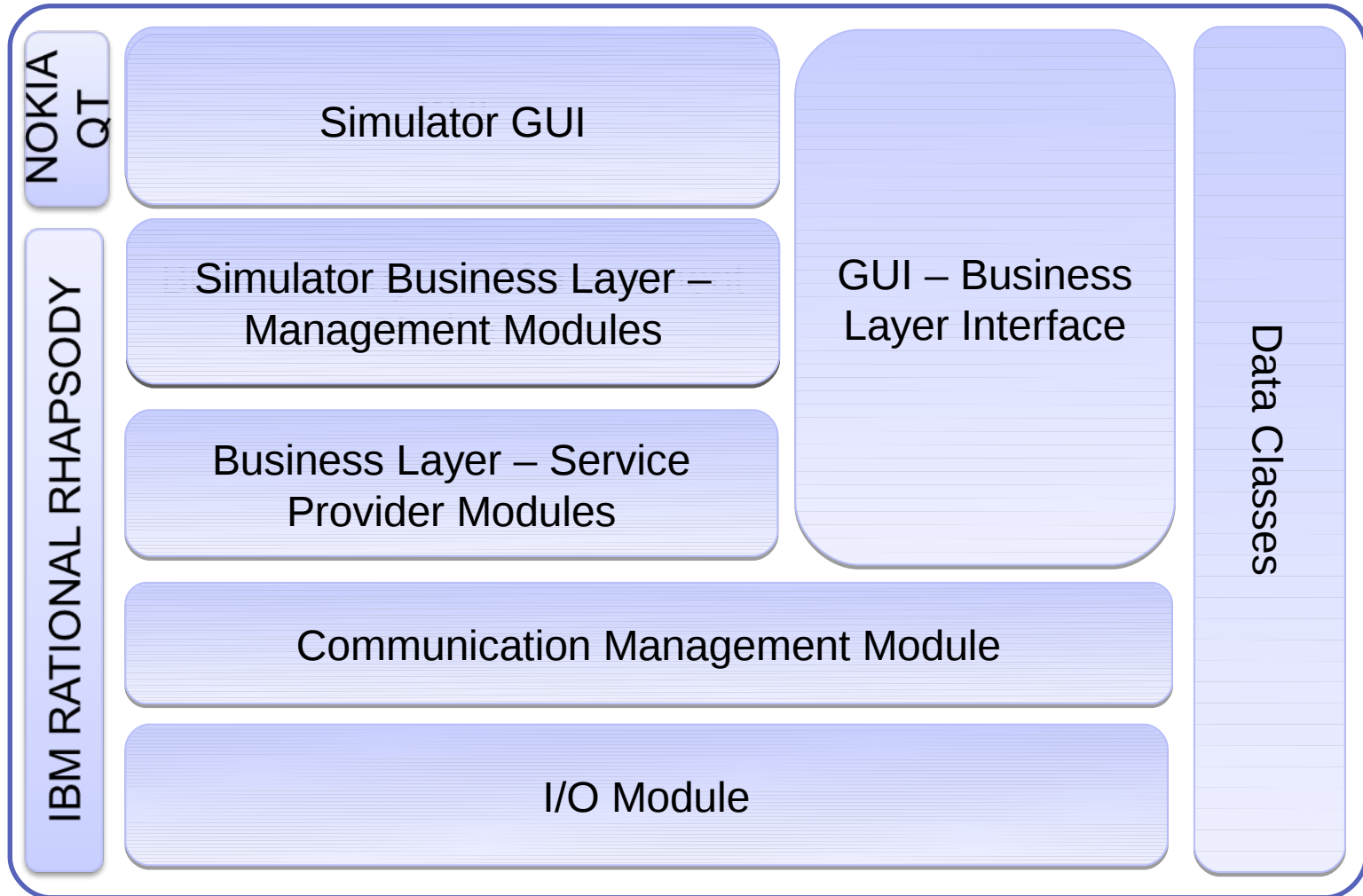
- Model Driven Development
- Layered Architecture
- Service Oriented Design



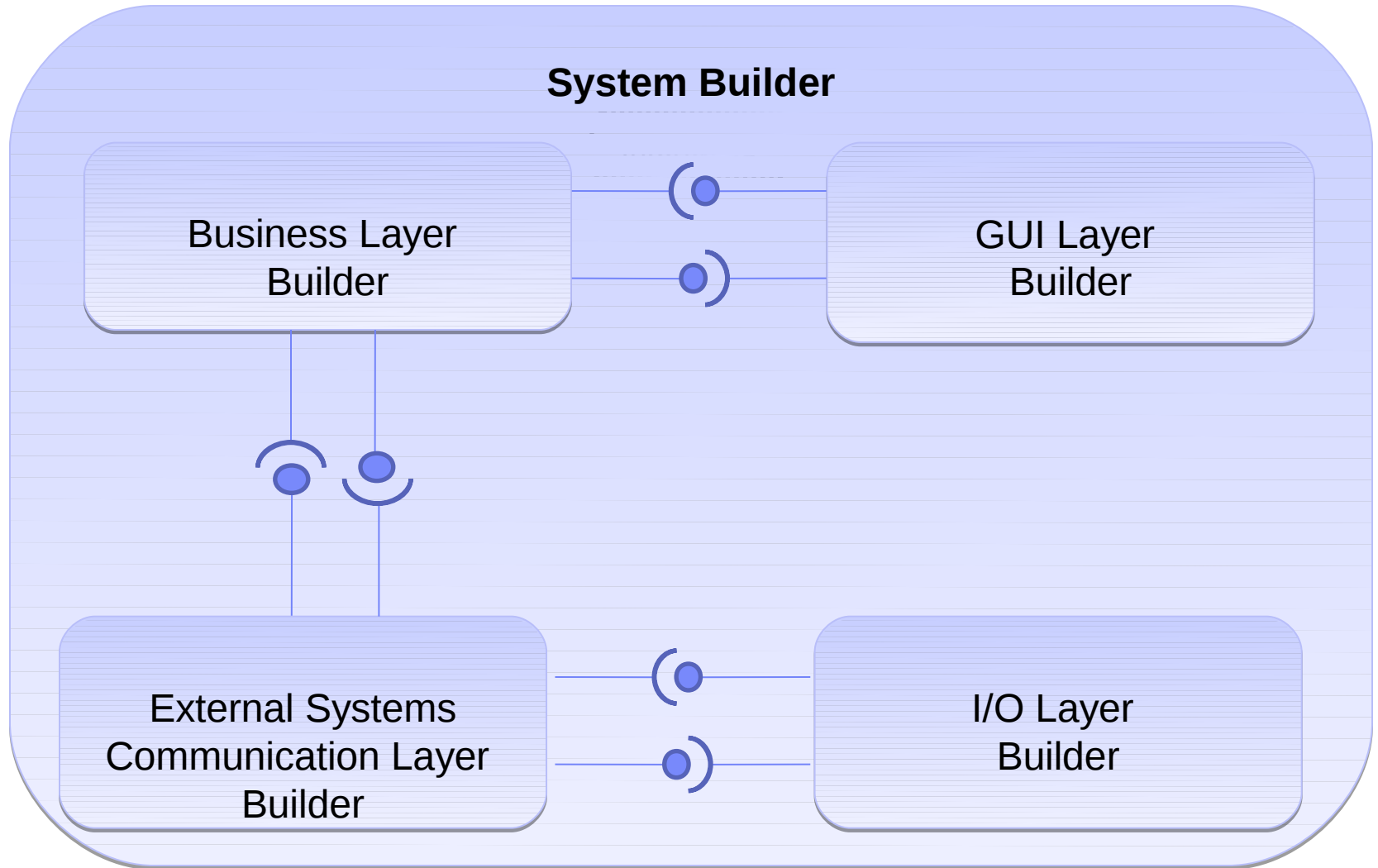
# Layered Architecture



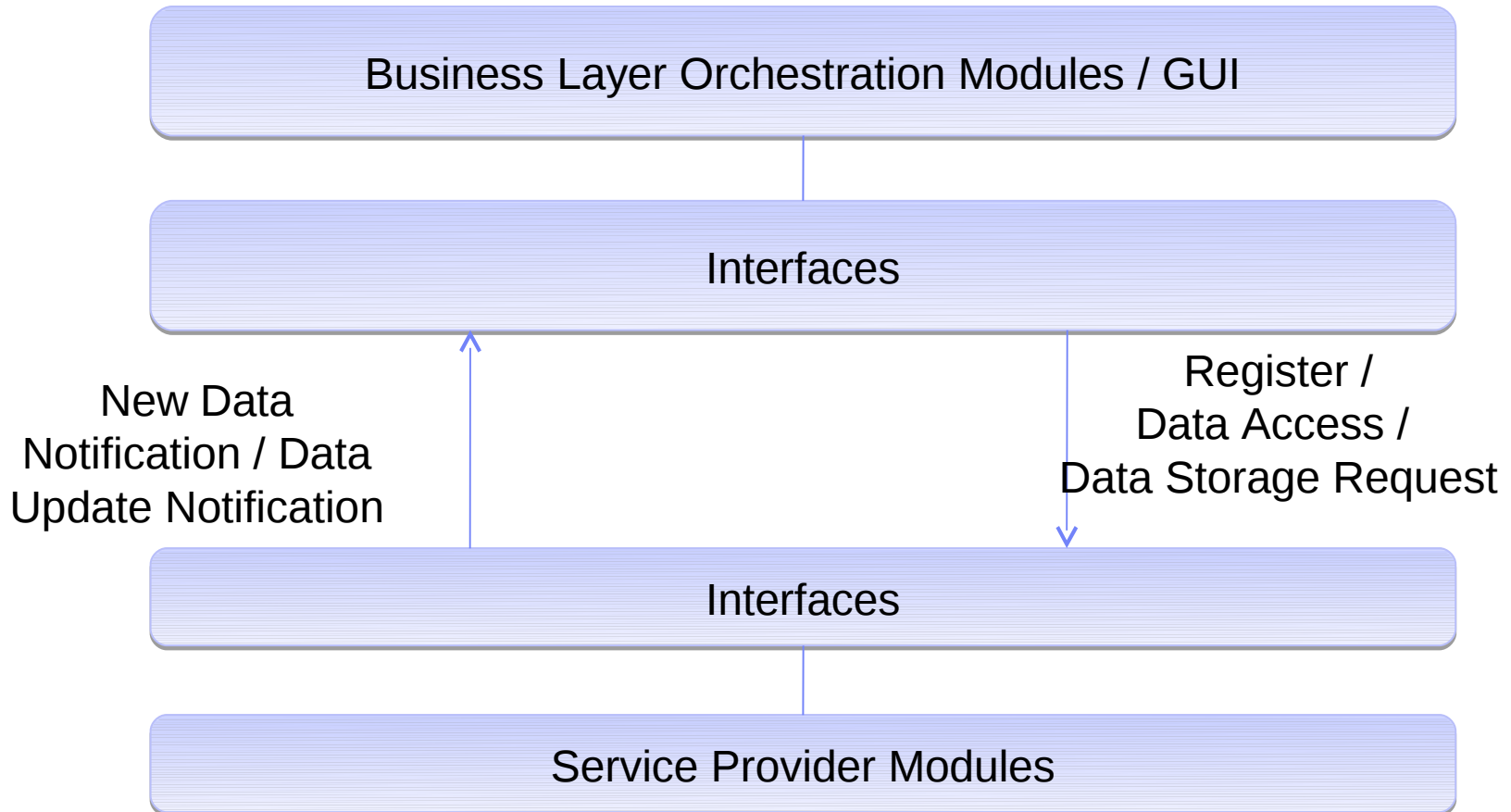
# Reuse



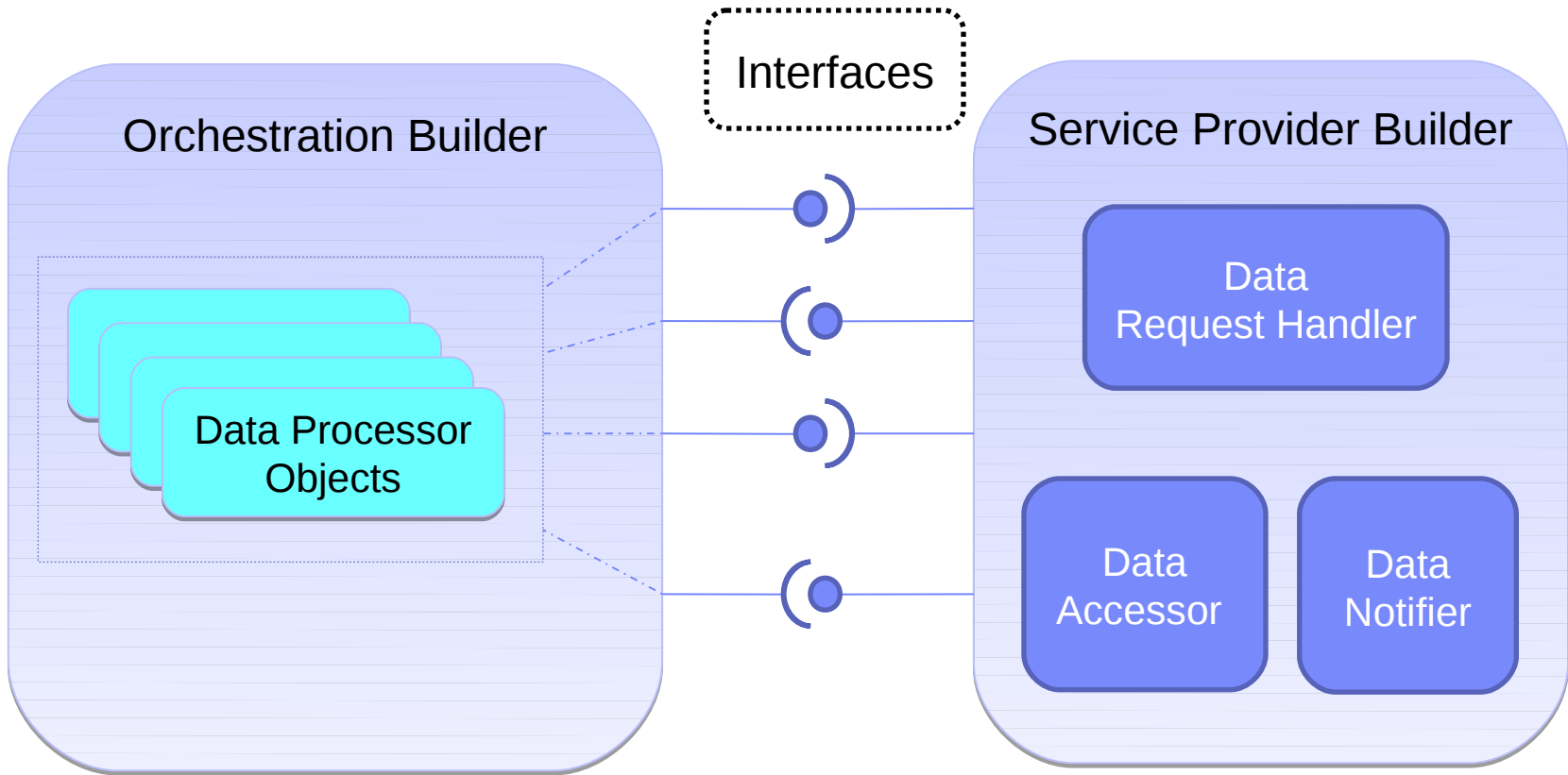
# System Decomposition



## Publisher/Subscriber Logic

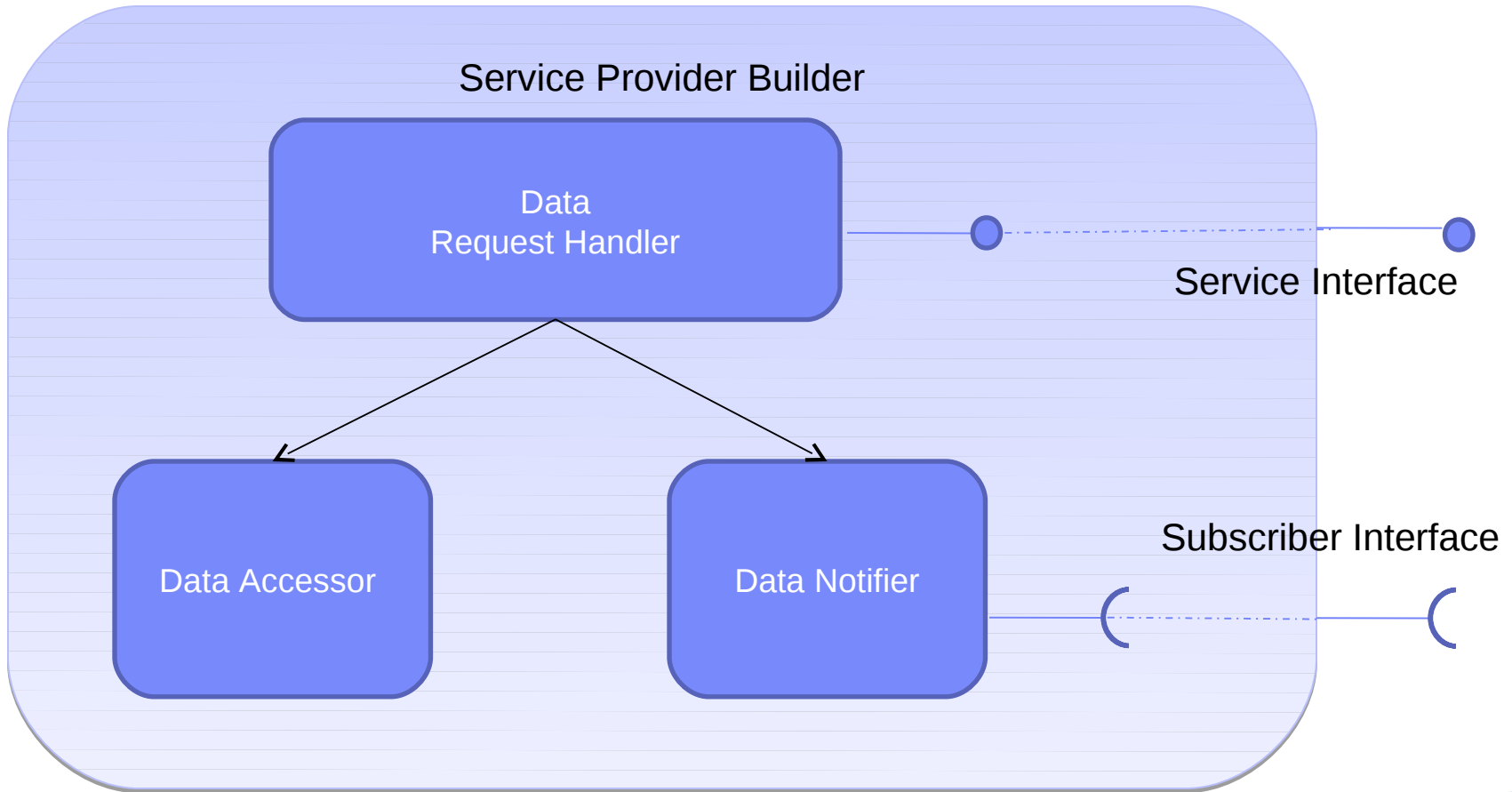


# Service Oriented Design





# Service Provider Component



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# IBM Rhapsody Profiling

## QtAddOn Profile

- Qt Header Macro Declaration
- Qt Public Slot Declaration
- Qt Public Slot Definiton
- Qt Signals Declaration

Class : QtRhapsodyDataInterface in QtRhapsodyInterfacePackage

General Description Attributes Operations Ports Flow Ports Relations Tags Properties

View Overridden ▾

CG	
Class	
StandardOperations	QtHeaderMacro,QtPublicSlot,QtSignals
File	
InvokePostProcessor	\$projectPath\PostProcessing.exe \$file
CPP_CG	
Class	
QtHeaderMacroDeclaration	Q_OBJECT
QtPublicSlotDeclaration	// Property QtPublicSlotDeclarationpublic slots: void slotSendDataDetail(int, I
QtPublicSlotDefinition	// Property QtPublicSlotDefinitionvoid \$Name::slotSendDataDetail(int dataNo,
QtSignalsDeclaration	// Property QtSignalDeclaration signals: void signalData(QVector<Data*>);
QtSignalsDefinition	// Property QtSignalDefinition
SpecIncludes	
Attribute	
ΔrecentGenerate	<input type="checkbox"/>

## IBM Rhapsody – Nokia Qt Integration

### GUI Level Integration

- OMEvent/Reception – Signal/Slot Integration



### IO Level Integration

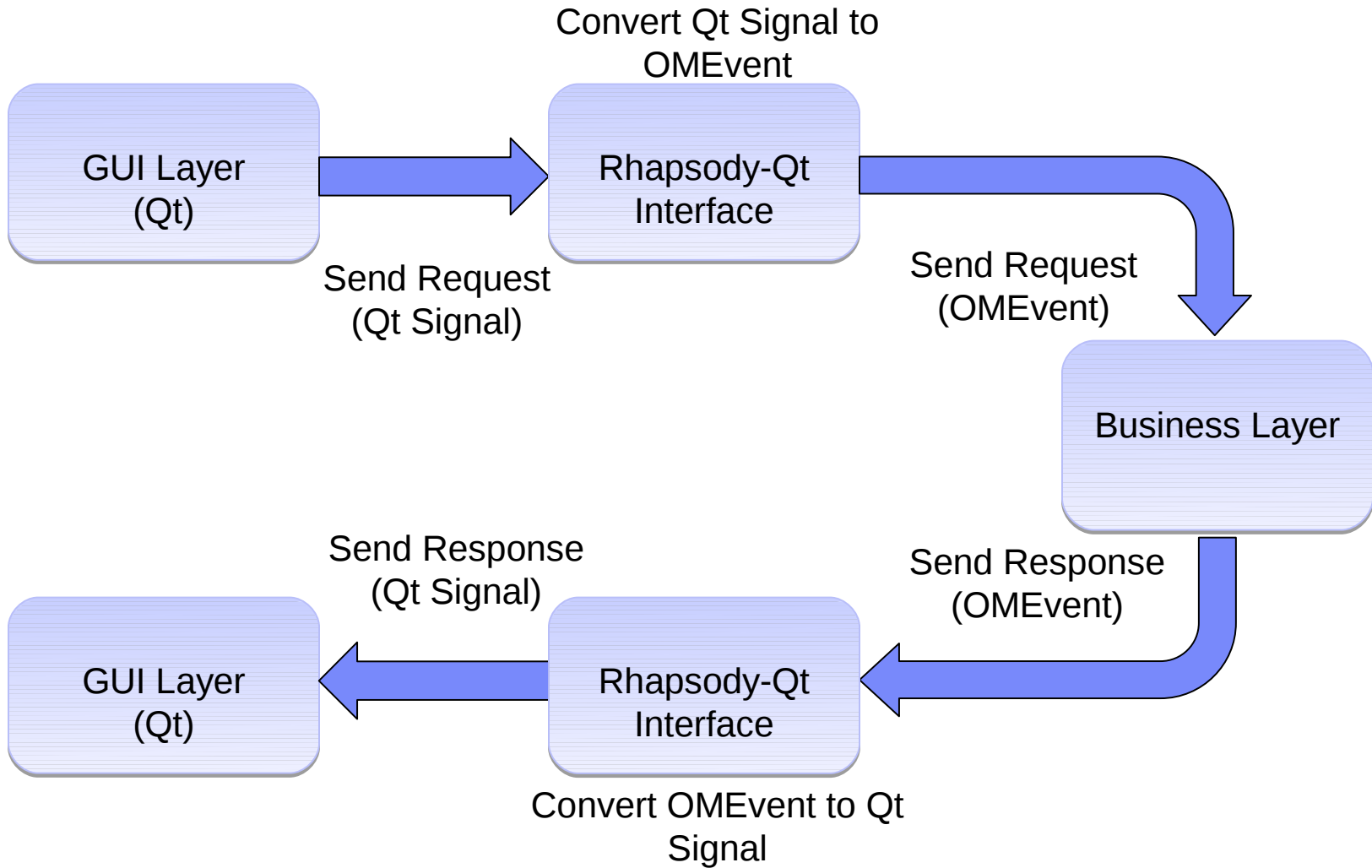
- OMThread – QThread Integration



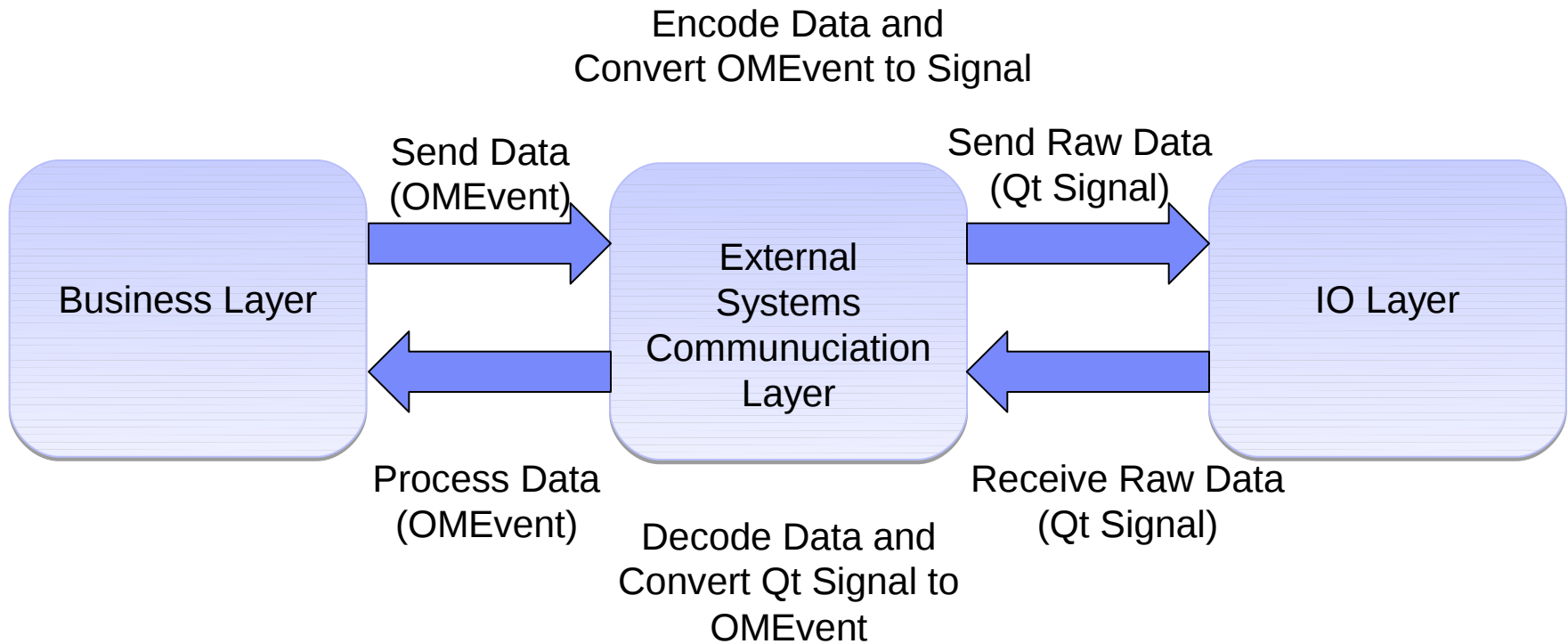
### Build/Link Integration

- .moc file integration

# GUI Level Integration



# I/O Level Integration



## Build/Link Integration

```
File Edit Format View Help
%QTDIR%\bin\moc.exe Class.h -o moc_Class.cpp
nmake -f ..\..\Repository\mockutuphanesi.mak
```

- .moc file for each Qt Class is generated with a batch file
- A library is built with moc files
- Library is linked to project

```
##### Commands definition #####
#####
RMDIR = rmdir
LIB_CMD=link.exe -lib
MOC_CMD=..\..\Repository\moc.bat
LINK_CMD=link.exe
LIB_FLAGS=$OMConfigurationLinkSwitches
LINK_FLAGS=$OMConfigurationLinkSwitches $(SUBSYSTEM) /I
```

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## Benefits of Using IBM Rational Rhapsody

- Platform Independency / RTOS Support
  - ✓ Windows
  - ✓ Linux
  - ✓ VxWorks
  
- Model level debugging
  - ✓ Statechart
  - ✓ Sequence Diagrams



## Benefits of Using IBM Rational Rhapsody Cont'd

- Low effort for design documentation
  - ✓ Design document generation in 1 day
- Requirements traceability to design and code
- Design once, use everywhere
  - ✓ Reusable components
- Easy multi-thread management
  - ✓ Over 100 threads running simultaneously



# QUESTIONS

[www.stm.com.tr](http://www.stm.com.tr)

[www.ibm.com/software/rational](http://www.ibm.com/software/rational)



[www.stm.com.tr](http://www.stm.com.tr)

[www.ibm.com/software/rational](http://www.ibm.com/software/rational)

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