



K-HIS FHIR 교육

구현중심의 FHIR 기술 시스템 구축 교육 및 실습

HealthAll 수석연구원 송 준 현

HealthAll 책임연구원 전 형 석

HealthAll 주임연구원 최 미 현

전체 목차

- **FHIR Profiling**
 - FHIR Shorthand + sushi +IG Publisher
- **FHIR Server**
 - Server configuration
 - Load conformance resources
- **FHIR Client**
 - CRUDS operation



FHIR Profiling

with FHIR Shorthand

HealthAll 책임연구원 전 형 석

목차

- **Installation**

- Visual Studio Code
- JAVA
- sushi
- IG Publisher

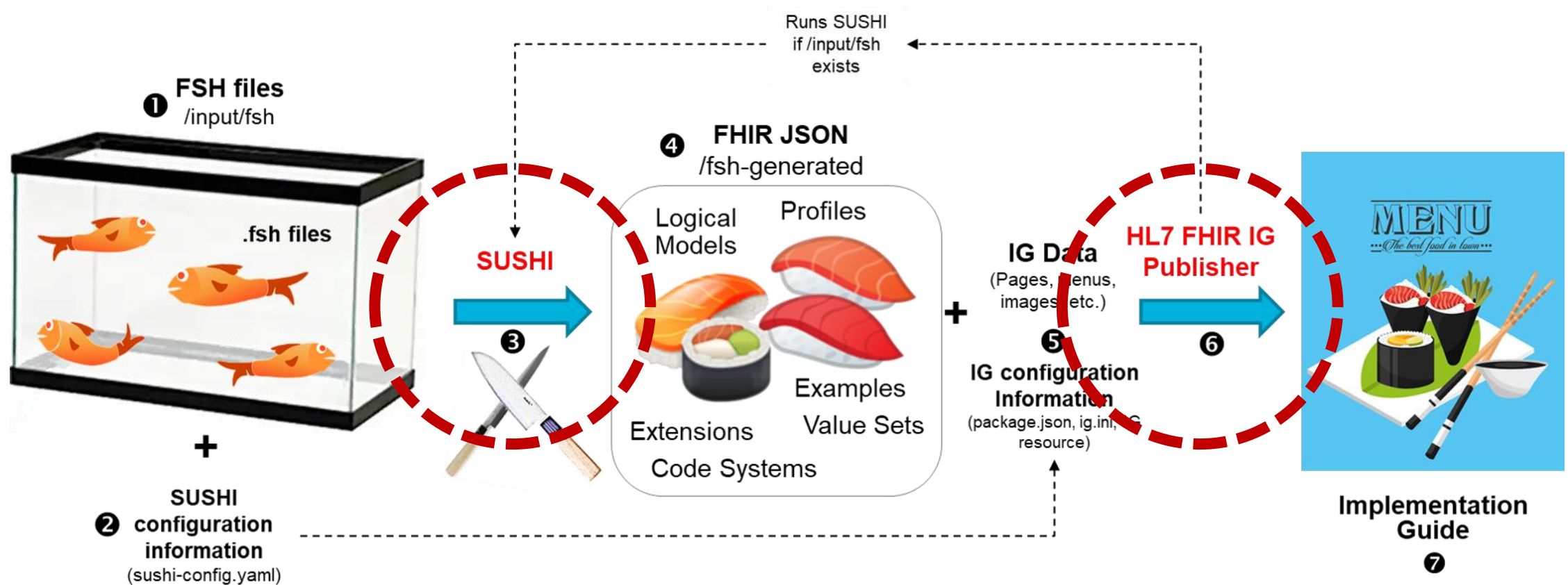
- **Profiling**

- Changing Cardinality
- Slicing
- ValueSet Binding

- **Validation**

- Against KR Core IG

Installation Guide



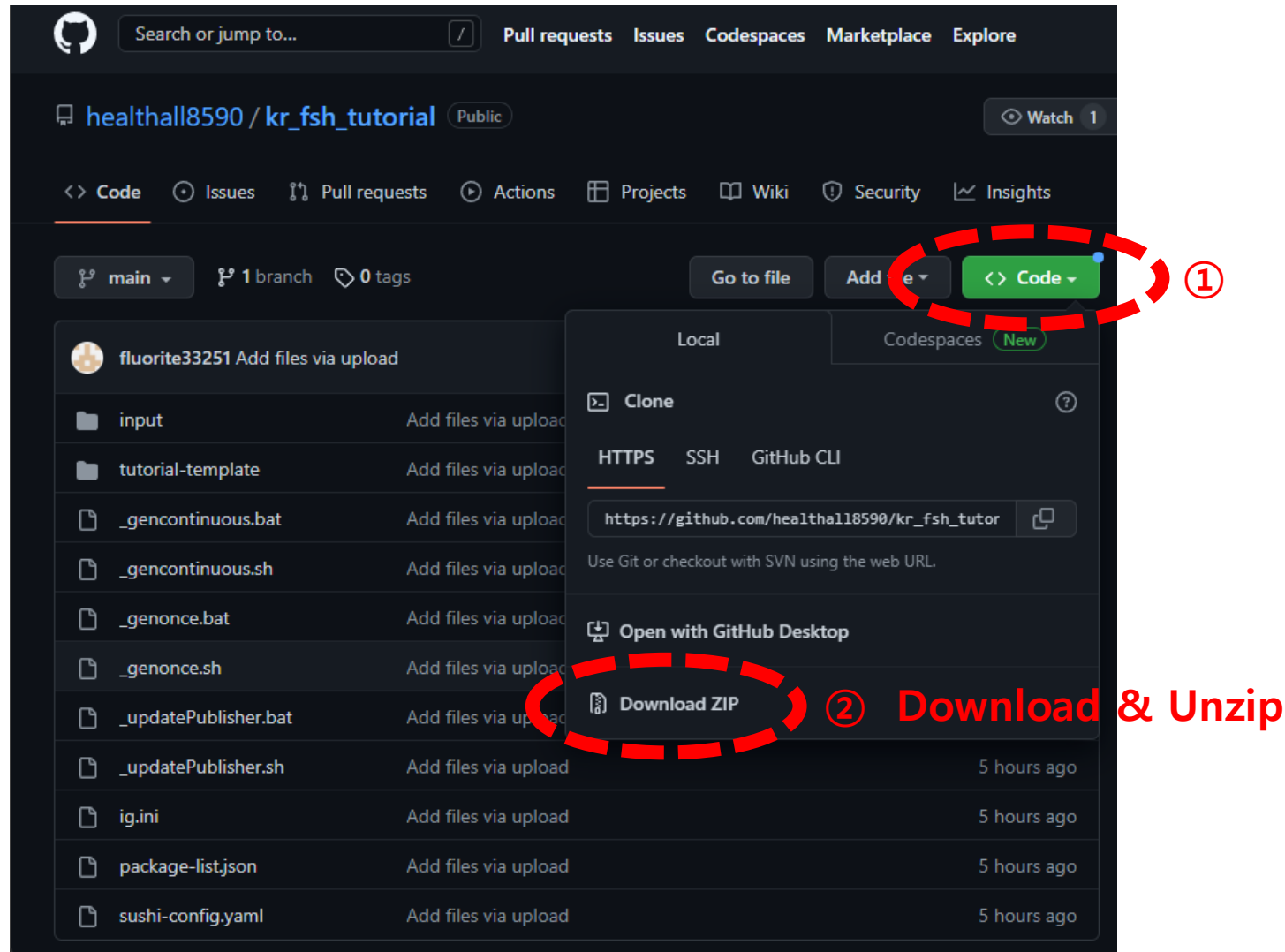
Credits: Sushi clipart from Google and WhatsApp rendering of Unicode 6.0 sushi emoji, Sushi menu from PNGWave, Non-Commercial Use, no attribution required (<https://www.pngwave.com/png-clip-art-oxoe/>)

- Required Installation
- Recommended Installation
- Tutorial Project

: SUSHI, IG Publisher, JAVA
: Visual Studio Code + FHIR Shorthand Extension
: Implementation Guide Tutorial

Download IG Tutorial Project (1)

- https://github.com/healthall8590/kr_fsh_tutorial



Download IG Tutorial Project (2)

<Project Structure>

```
kr_fsh_tutorial
├── input
│   ├── fsh
│   │   ├── MyPatient.fsh
│   │   ├── MyObservation.fsh
│   │   ├── MyObsCodeSystem.fsh
│   │   └── MyObsValueSet.fsh
│   ├── images
│   │   └── ...
│   ├── pagecontent
│   │   └── ...
│   └── ignoreWarnings.txt
├── tutorial-template
│   └── ...
├── _genonce.bat
├── _updatePublisher.bat
├── ig.ini
├── sushi-config.yaml
└── ...
```

- ... \kr_fsh_tutorial\input\fsh
 - FHIR Shorthand로 작성된 fsh 파일들이 위치한 폴더
- ... \kr_fsh_tutorial\tutorial-template
 - Implementation Guide 생성에 사용되는 웹사이트 템플릿
- ... \kr_fsh_tutorial_genonce.bat
 - Implementation Guide 생성에 사용되는 스크립트
- ... \kr_fsh_tutorial_updatePublisher.bat
 - IG Publisher 및 관련 파일 다운로드/업데이트에 사용되는 스크립트

Visual Studio Code (1)

- Step 1 – VS Code 설치

- <https://code.visualstudio.com/>

Visual Studio Code Docs Updates Blog API Extensions FAQ Learn Search Docs Download

Version 1.73 is now available! Read about the new features and fixes from October.

Code editing.
Redefined.

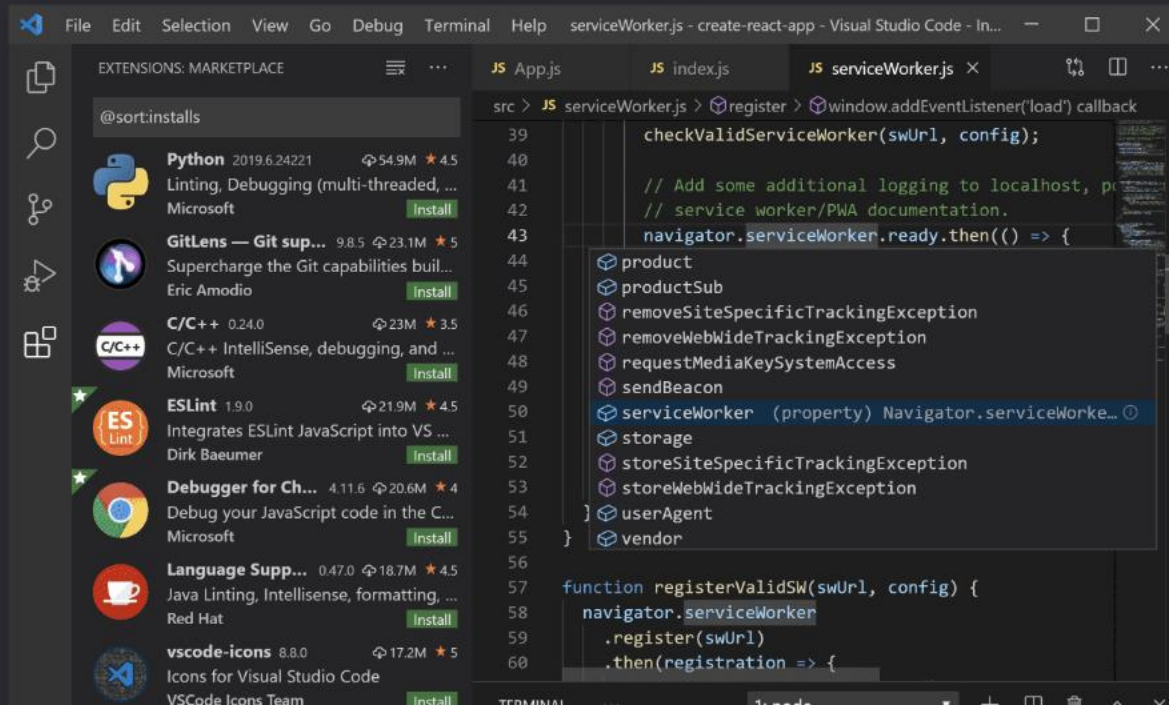
Free. Built on open source. Runs everywhere.

Download for Windows
Stable Build

Web, Insiders edition, or other platforms

Download & Install

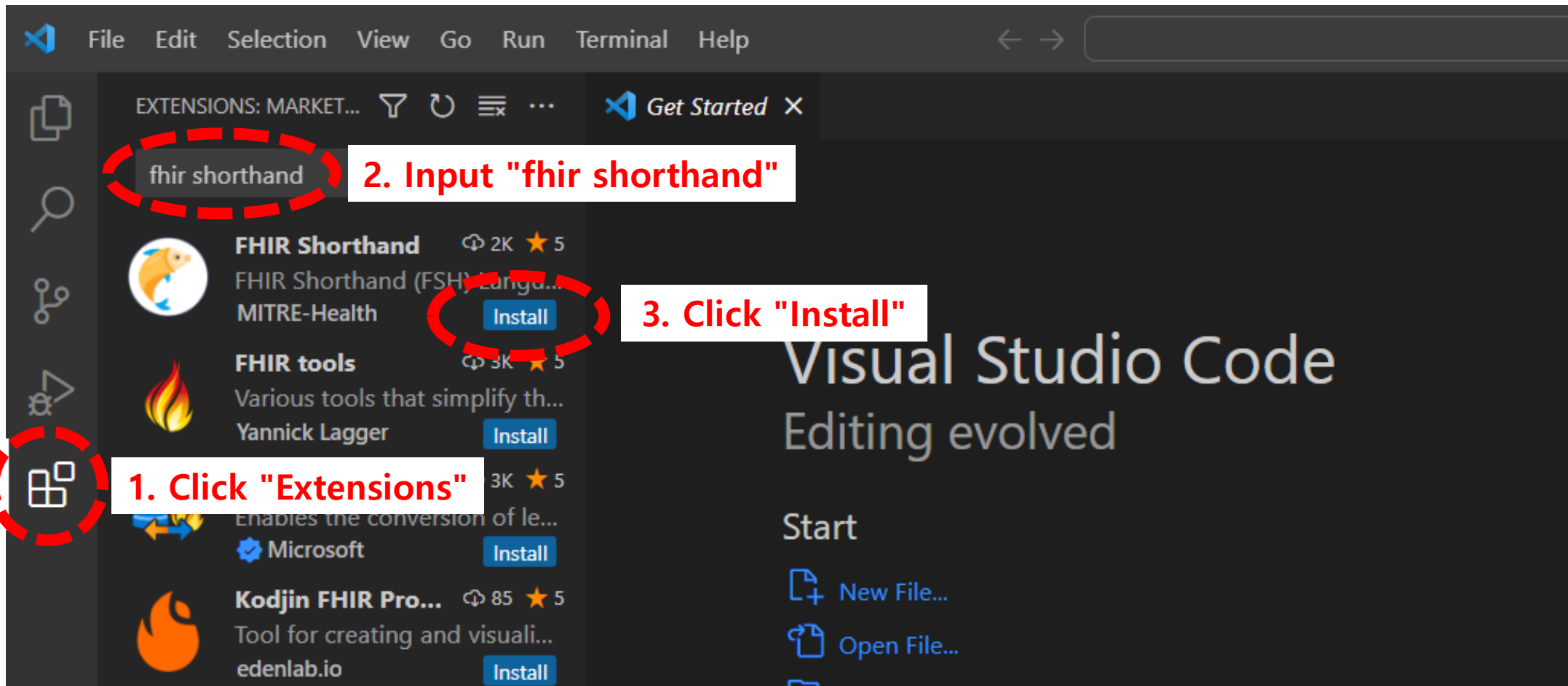
By using VS Code, you agree to its
license and privacy statement.



Visual Studio Code (2)

- **Step 2 – VS Code 설치**

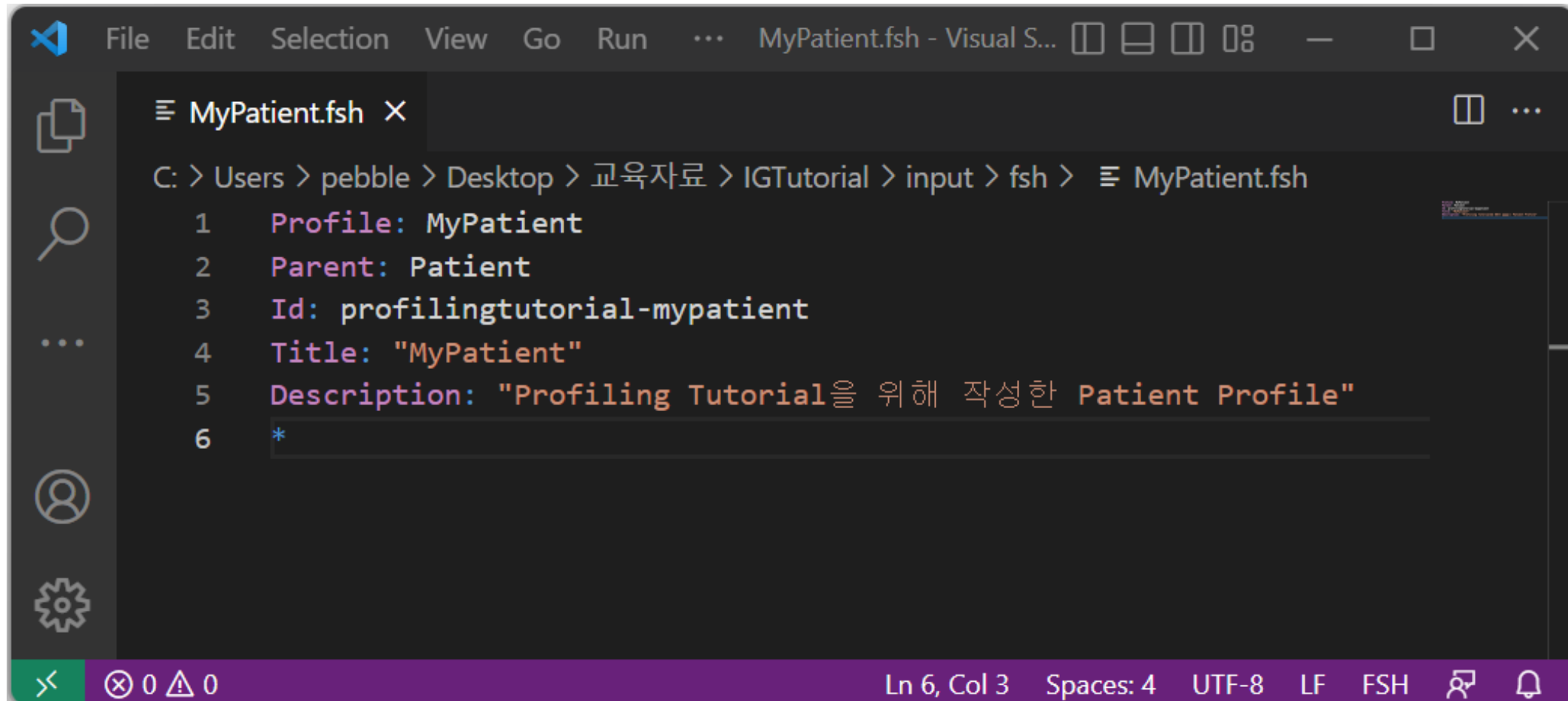
- VS Code 실행 – Extensions – FHIR shorthand 검색 및 설치



Visual Studio Code (3)

- **Step 3 – VS Code 설치 확인**

- ... \kr_fsh_tutorial\input\fsh\MyPatient.fsh 파일 VS Code로 열기



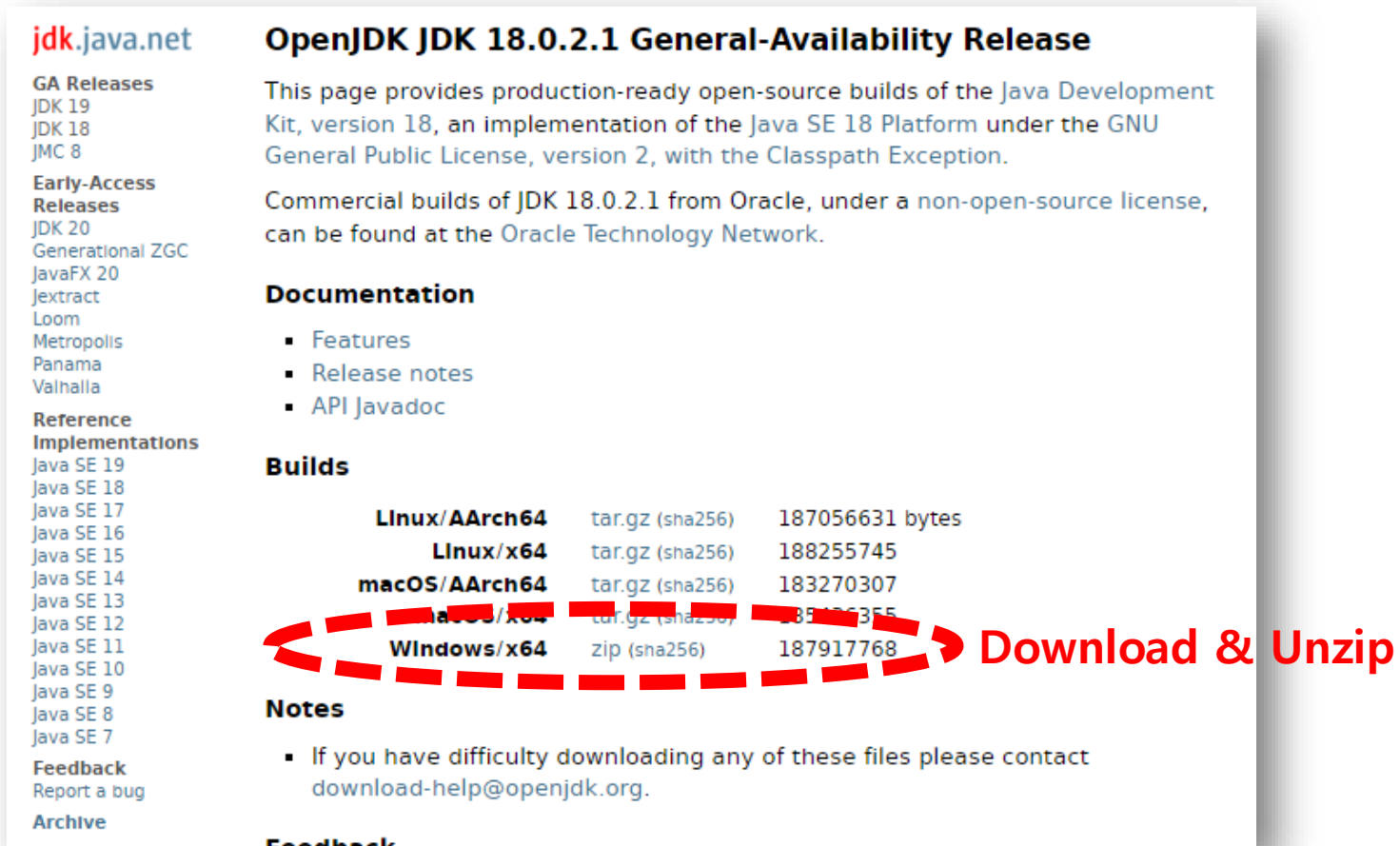
```
File Edit Selection View Go Run ... MyPatient.fsh - Visual S...
MyPatient.fsh
C: > Users > pebble > Desktop > 교육자료 > IGTutorial > input > fsh > MyPatient.fsh
1 Profile: MyPatient
2 Parent: Patient
3 Id: profilingtutorial-mypatient
4 Title: "MyPatient"
5 Description: "Profiling Tutorial을 위해 작성한 Patient Profile"
6 *
```

Ln 6, Col 3 Spaces: 4 UTF-8 LF FSH

JAVA Installation (1)

- **Step 1 – OpenJDK Download & Unzip**

- <https://jdk.java.net/18/>
- JAVA 17 (64-bit) 이상



jdk.java.net

GA Releases
JDK 19
JDK 18
JMC 8

Early-Access Releases
JDK 20
Generational ZGC
JavaFX 20
Jextract
Loom
Metropolis
Panama
Valhalla

Reference Implementations
Java SE 19
Java SE 18
Java SE 17
Java SE 16
Java SE 15
Java SE 14
Java SE 13
Java SE 12
Java SE 11
Java SE 10
Java SE 9
Java SE 8
Java SE 7

Feedback
Report a bug

Archive

OpenJDK JDK 18.0.2.1 General-Availability Release

This page provides production-ready open-source builds of the Java Development Kit, version 18, an implementation of the Java SE 18 Platform under the GNU General Public License, version 2, with the Classpath Exception.

Commercial builds of JDK 18.0.2.1 from Oracle, under a non-open-source license, can be found at the Oracle Technology Network.

Documentation

- Features
- Release notes
- API Javadoc

Builds

Linux/AArch64	tar.gz (sha256)	187056631 bytes
Linux/x64	tar.gz (sha256)	188255745
macOS/AArch64	tar.gz (sha256)	183270307
macOS/x64	tar.gz (sha256)	185126355
Windows/x64	zip (sha256)	187917768


Notes

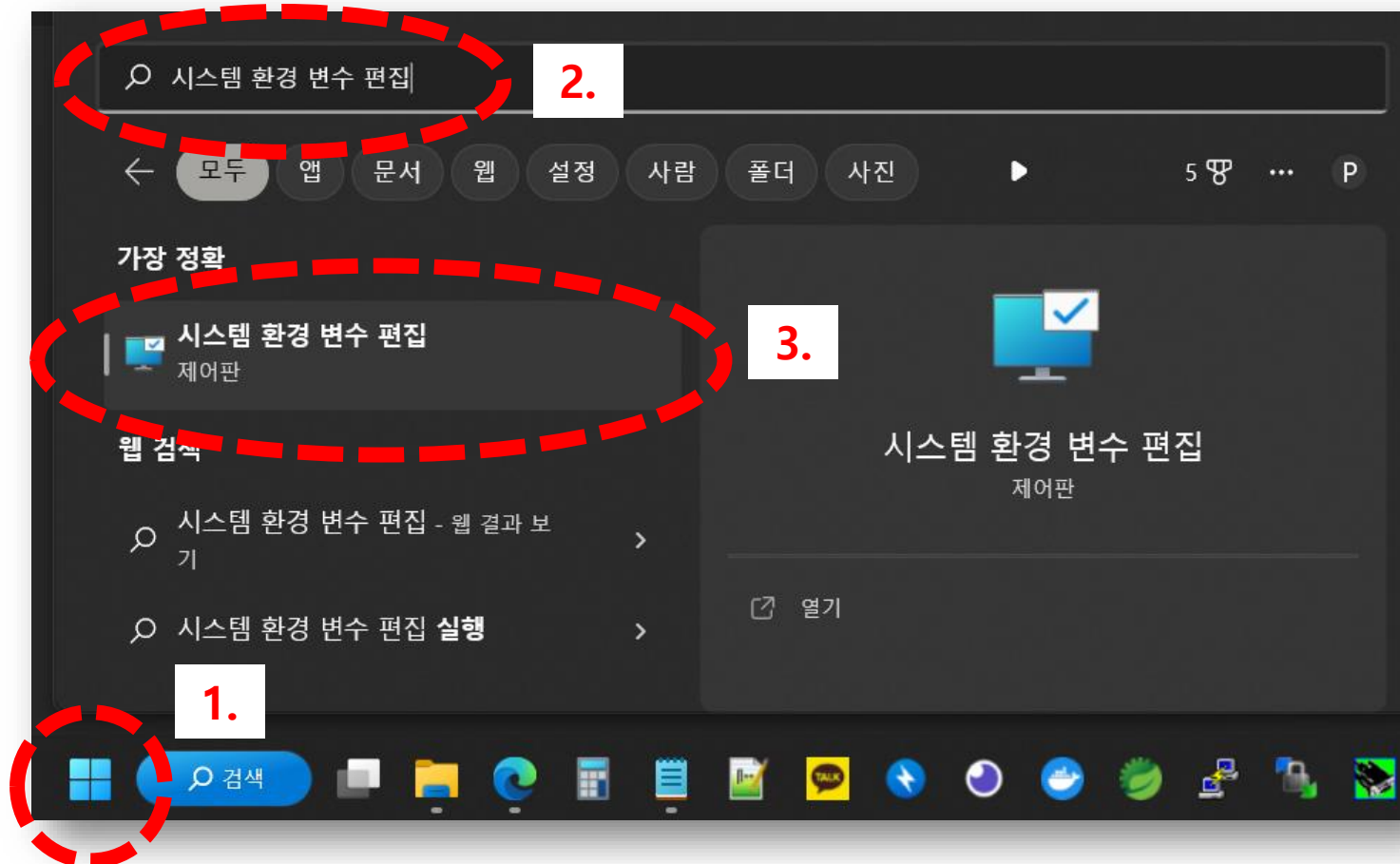
- If you have difficulty downloading any of these files please contact download-help@openjdk.org.

Feedback

JAVA Installation (2)

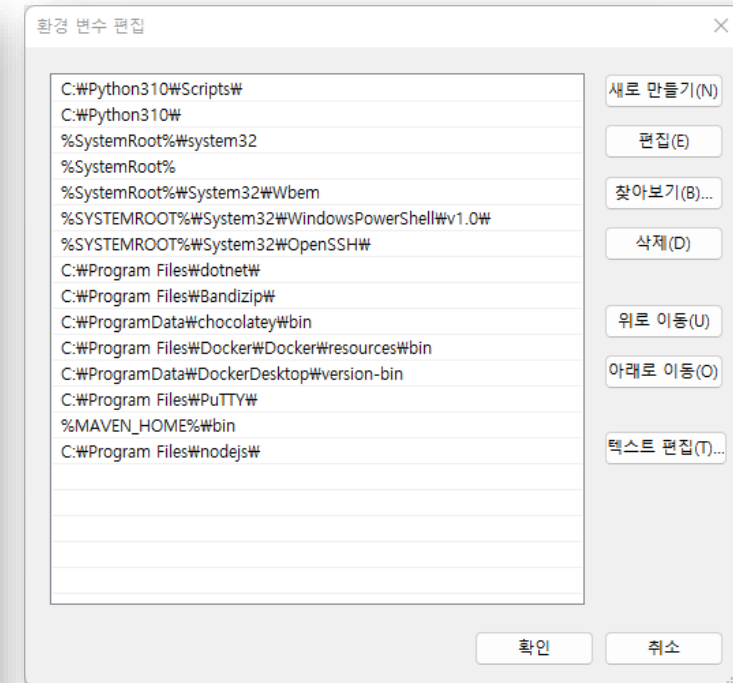
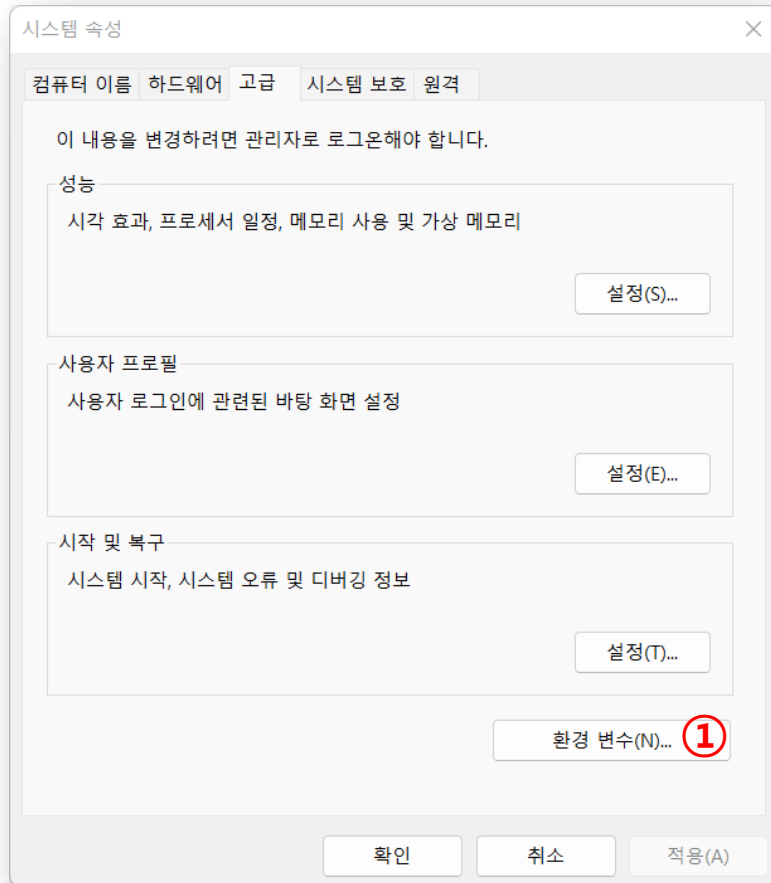
• Step 2 – System Environment Setting (1)

- Windows 시작 버튼  → '시스템 환경 변수 편집' 검색 → 실행
- Example)



JAVA Installation (3)

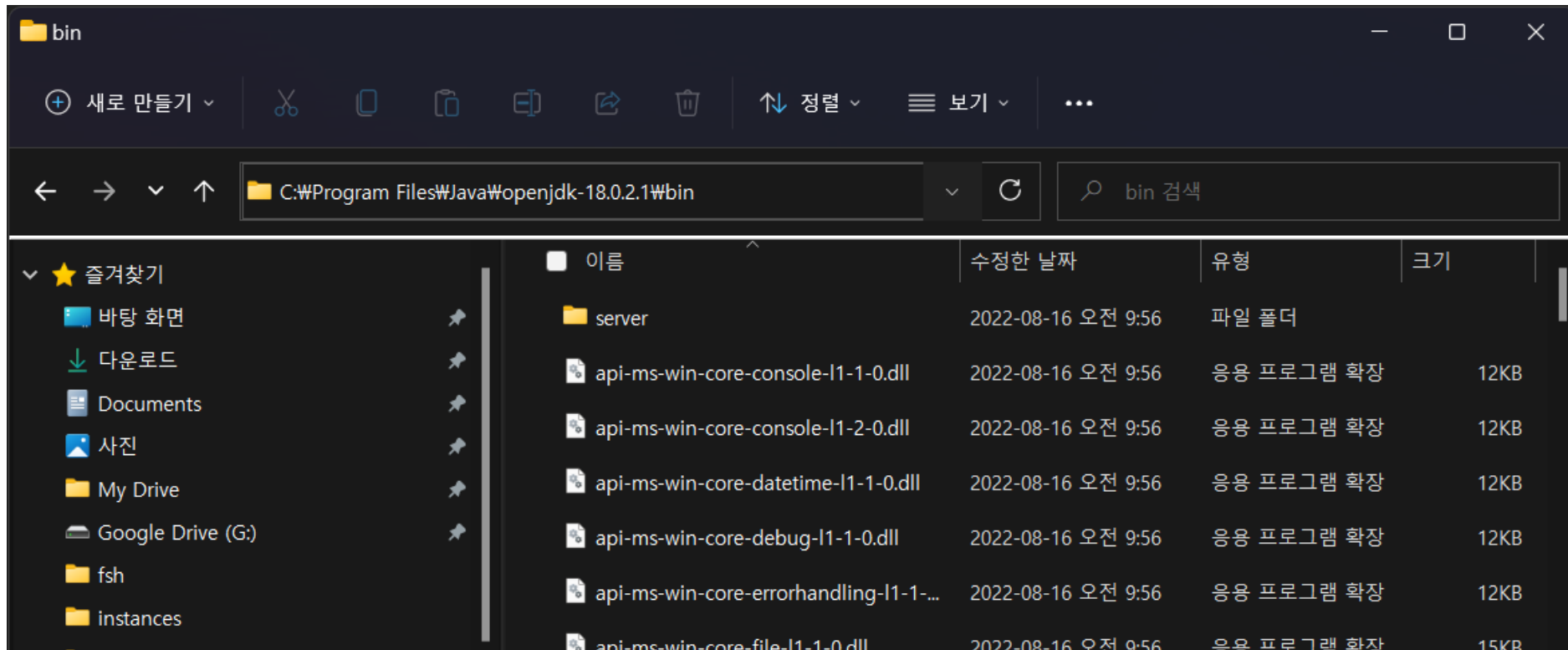
• Step 3 – System Environment Setting (2)



JAVA Installation (4)

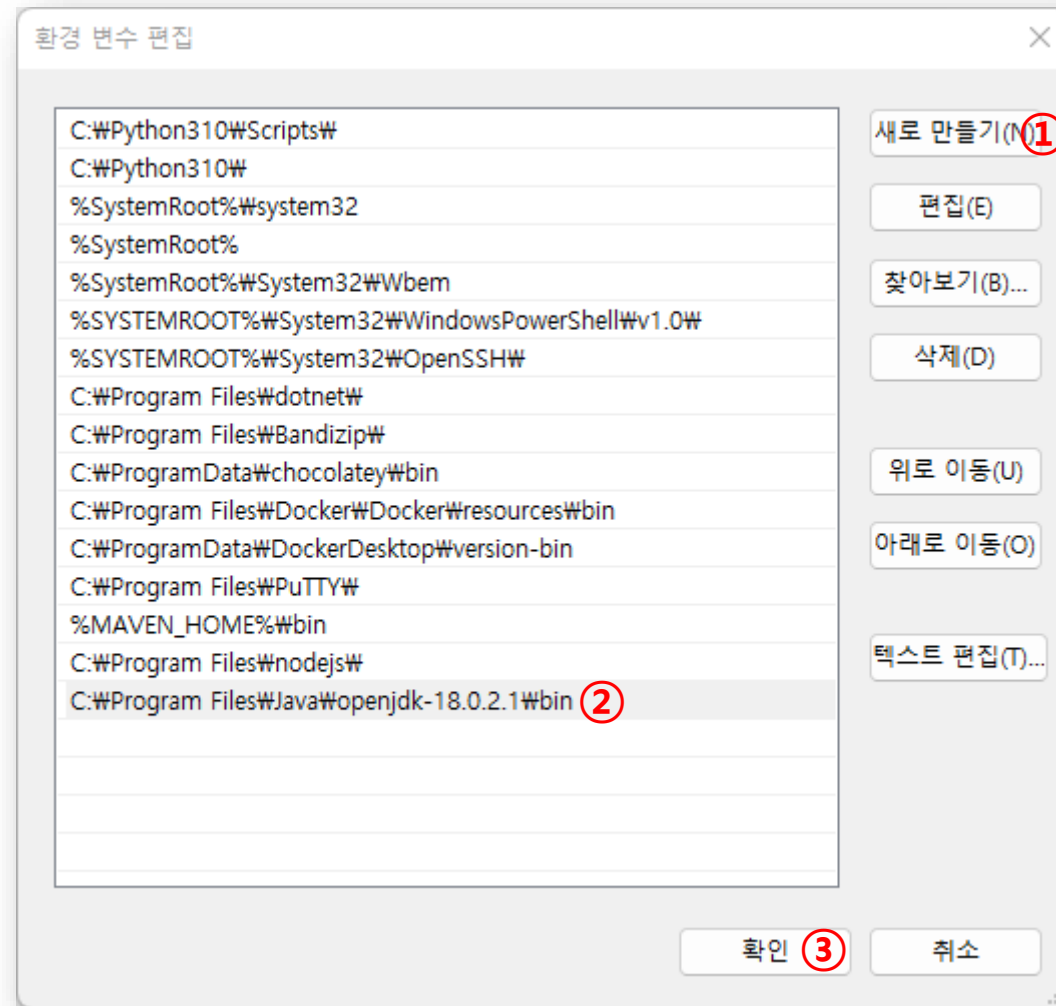
• Step 3 – System Environment Setting (3)

- openJDK 내 bin 폴더까지의 경로를 복사
- Example)
 - C:\Program Files\Java\openjdk-18.0.2.1\bin



JAVA Installation (5)

- **Step 3 – System Environment Setting (3)**
 - 복사한 경로를 새로운 환경 변수로 등록



JAVA Installation (6)

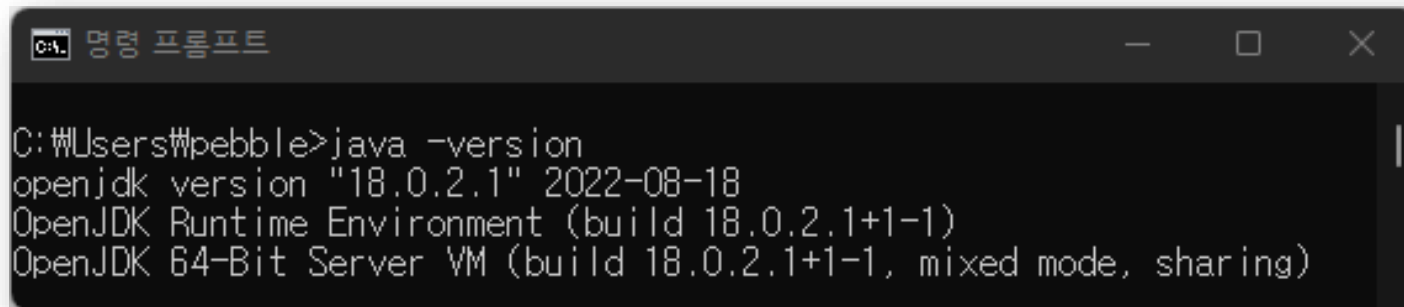
- **Step 4 – JAVA 설치 확인**

- 명령프롬프트에서 아래 커맨드입력



```
java -version
```

- Example



```
C:\Users\pebble>java -version
openjdk version "18.0.2.1" 2022-08-18
OpenJDK Runtime Environment (build 18.0.2.1+1-1)
OpenJDK 64-Bit Server VM (build 18.0.2.1+1-1, mixed mode, sharing)
```


SUSHI Installation (1)

- **Step 1 – Node.js + NPM 설치**
 - <https://nodejs.org/>



SUSHI Installation (2)

- **Step 2 – Node.js**

- 명령프롬프트(cmd)에서 아래 커맨드 입력

```
node --version  
npm --version
```

- Example

```
명령 프롬프트  
Microsoft Windows [Version 10.0.19044.1889]  
(c) Microsoft Corporation. All rights reserved.  
  
C:\Users\pebble>node --version  
v18.12.1  
  
C:\Users\pebble>npm --version  
8.19.2  
  
C:\Users\pebble>
```

SUSHI Installation (3)

- **Step 3 – SUSHI 설치**

- 명령프롬프트에서 아래 커맨드입력

```
npm install -g fsh-sushi
```

- Example

```
C:\Users\pebble>npm install -g fsh-sushi
added 107 packages, and audited 116 packages in 28s
1 high severity vulnerability
To address all issues, run:
  npm audit fix
Run `npm audit` for details.
npm notice
npm notice New major version of npm available! 8.19.2 -> 9.1.2
npm notice Changelog: https://github.com/npm/cli/releases/tag/v9.1.2
npm notice Run npm install -g npm@9.1.2 to update!
npm notice
```

무시(npm 업데이트 요구)

SUSHI Installation (4)

- **Step 4 – SUSHI 설치 확인**
 - 명령프롬프트에서 아래 커맨드입력



```
sushi -v
```

- Example



```
C:\Windows\system32\cmd.exe  
C:\Users\pebble>sushi -v  
SUSHI v2.7.0 (implements FHIR Shorthand specification v2.0.0)  
C:\Users\pebble>
```

IG Publisher Installation (1)

- Step 1 – Ruby 설치 (1)

- <https://rubyinstaller.org/downloads/>



RubyInstaller
for Windows

Downloads

RubyInstallers **Archives»**

Not sure what version to download? Please read the right-hand column for recommendations.

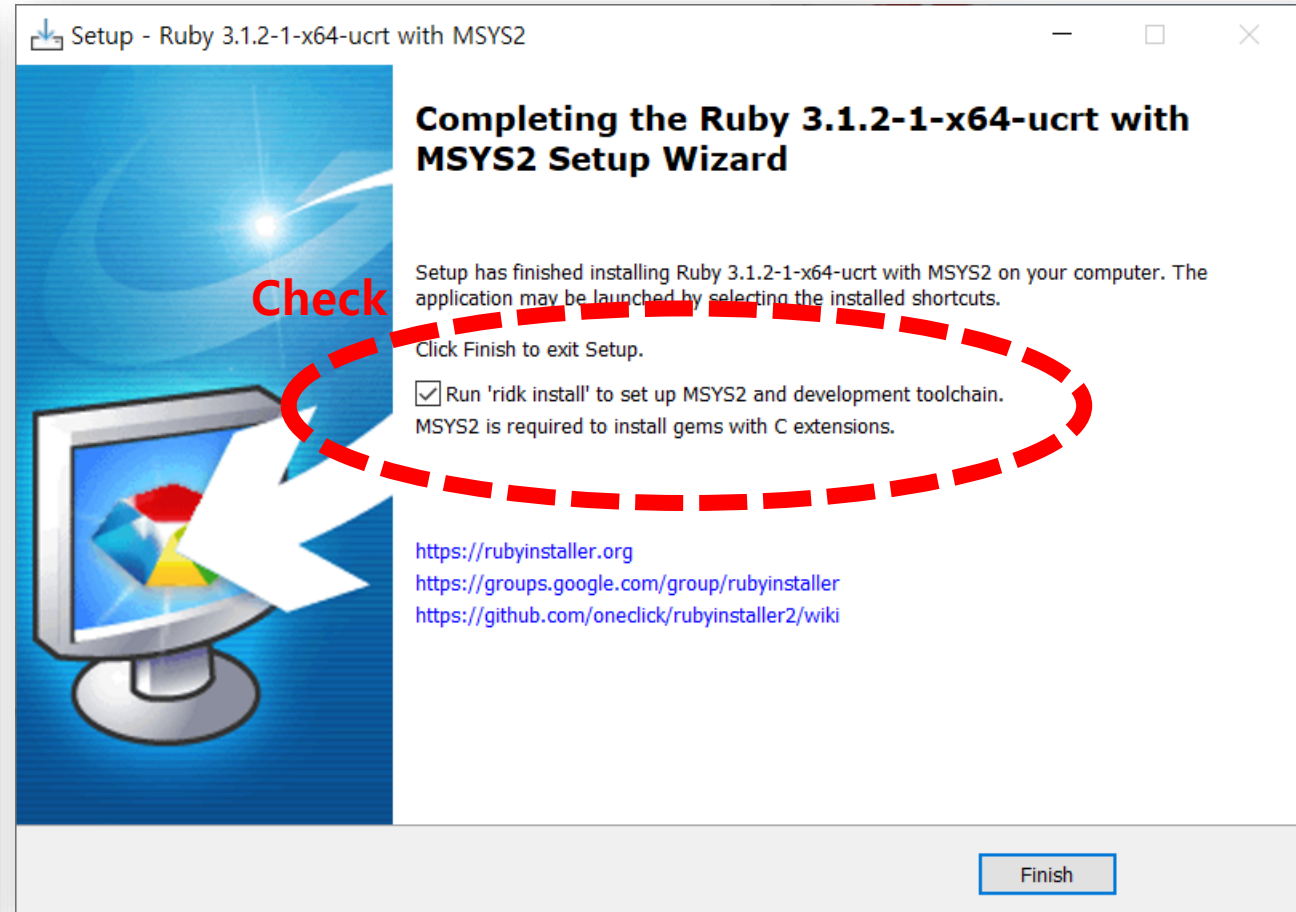
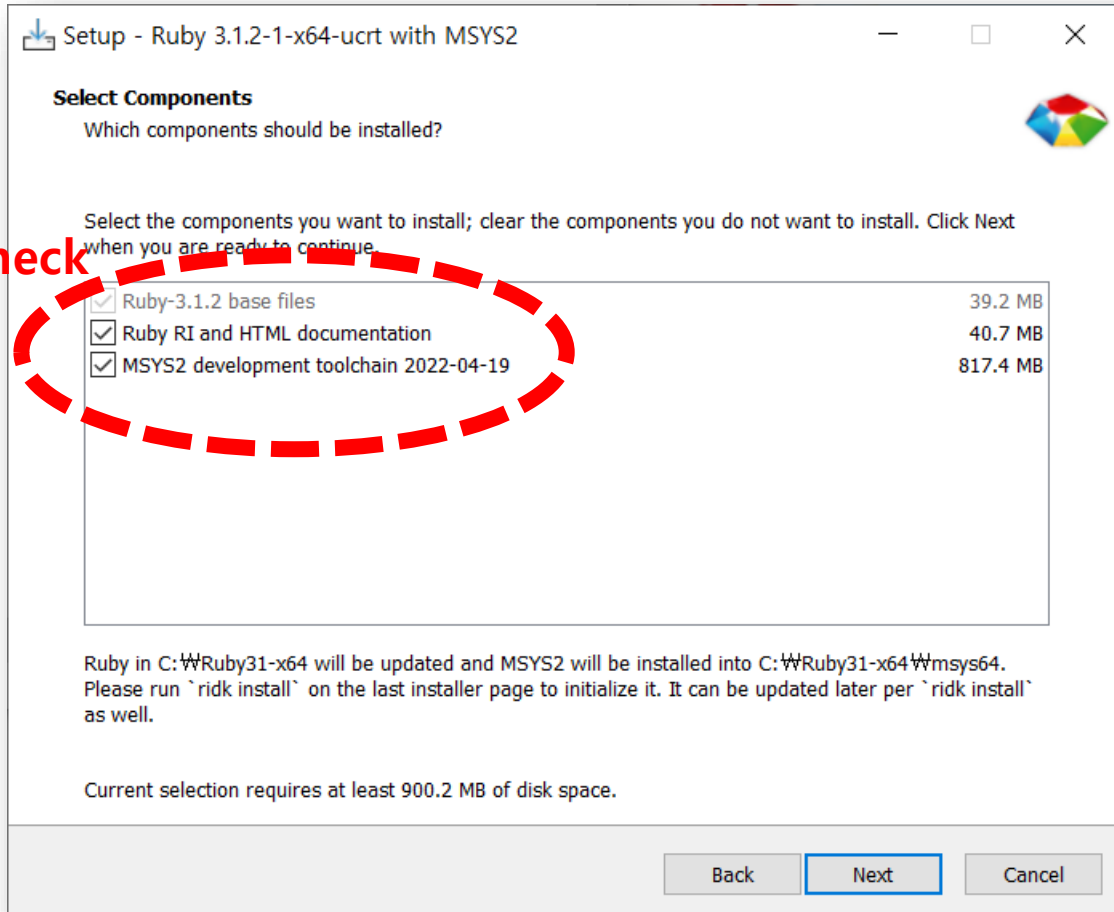
WITH DEVKIT

	=> Ruby+Devkit 3.1.2-1 (x64)	
	Ruby+Devkit 3.1.2-1 (x86)	
	Ruby+Devkit 3.0.4-1 (x64)	
	Ruby+Devkit 3.0.4-1 (x86)	
	Ruby+Devkit 2.7.6-1 (x64)	
	Ruby+Devkit 2.7.6-1 (x86)	
	Ruby+Devkit 2.6.10-1 (x64)	
	Ruby+Devkit 2.6.10-1 (x86)	

Download & Install

IG Publisher Installation (2)

• Step 1 – Ruby 설치 (2)



IG Publisher Installation (3)

• Step 1 – Ruby 설치 (3)



```
C:\WINDOWS\system32\cmd.exe

RubyInstaller
For Windows

1 - MSYS2 base installation
2 - MSYS2 system update (optional)
3 - MSYS2 and MINGW development toolchain

Which components shall be installed? If unsure press ENTER [1,3] press Enter
```

IG Publisher Installation (4)

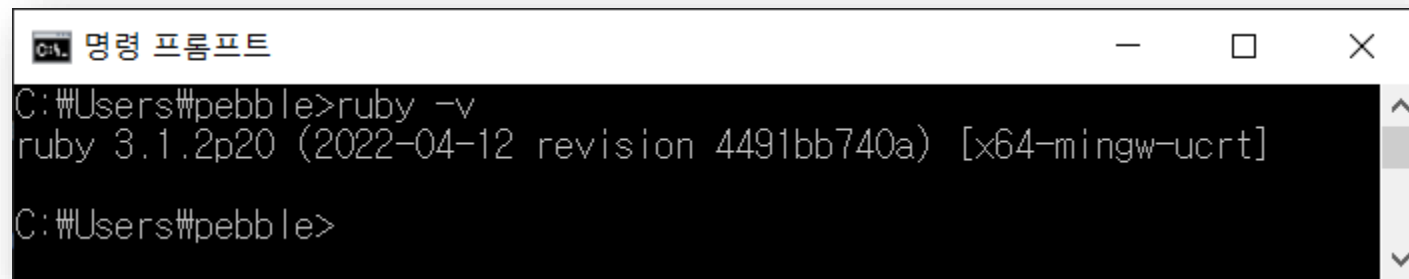
- **Step 2 – Ruby 설치 확인**

- 명령프롬프트에서 아래 커맨드입력



```
ruby -v
```

- Example

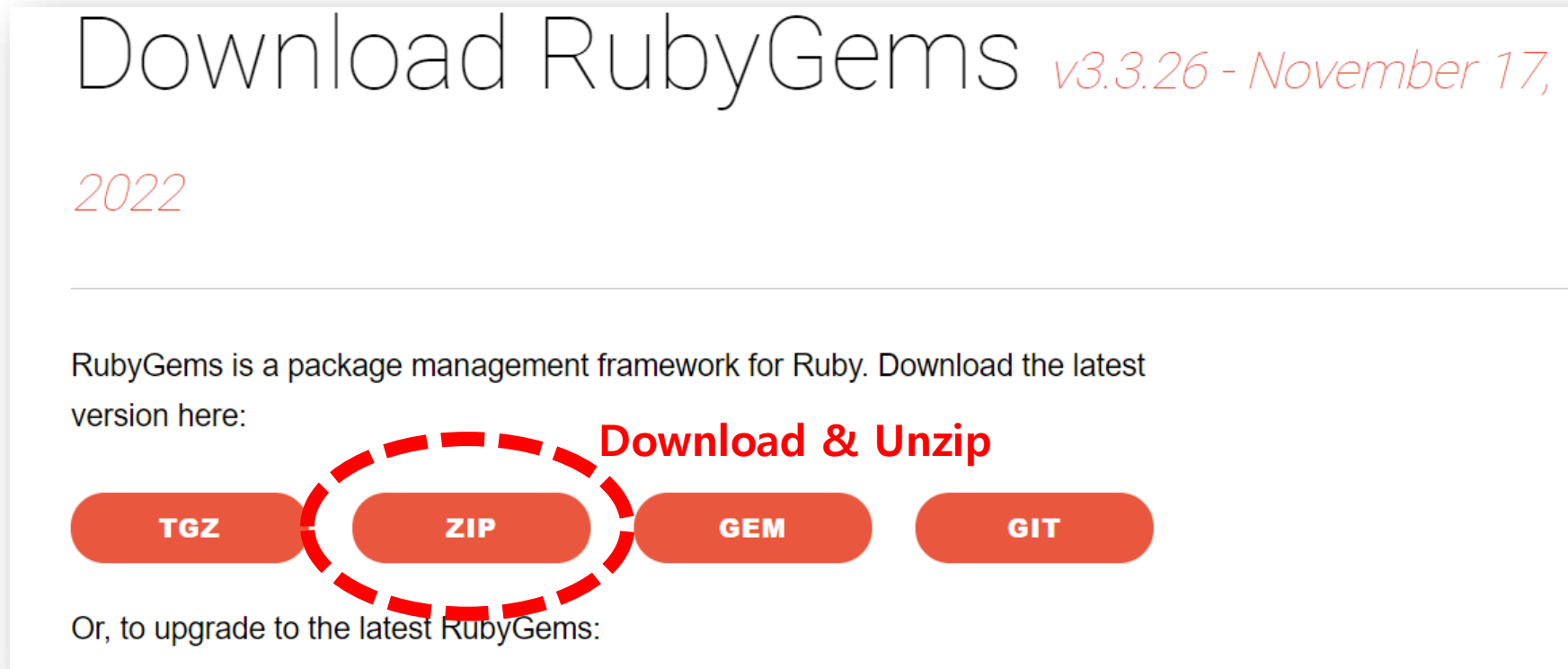


```
C:\Users\pebble>ruby -v
ruby 3.1.2p20 (2022-04-12 revision 4491bb740a) [x64-mingw-ucrt]
C:\Users\pebble>
```


IG Publisher Installation (5)

- **Step 3 – RubyGems 설치 (1)**

- <https://rubygems.org/pages/download>



Download RubyGems *v3.3.26 - November 17, 2022*

RubyGems is a package management framework for Ruby. Download the latest version here:

Download & Unzip

TGZ ZIP GEM GIT

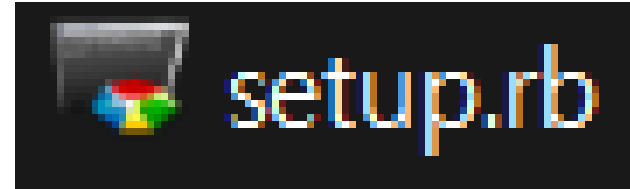
Or, to upgrade to the latest RubyGems:

IG Publisher Installation (6)

• Step 3 – RubyGems 설치 (2)

- 압축 해제 후 설치 – setup.rb

이름	수정한 날짜	유형	크기
bin	2022-11-17 오후 4:14	파일 폴더	
bundler	2022-11-17 오후 4:14	파일 폴더	
hide_lib_for_update	2022-11-17 오후 4:14	파일 폴더	
lib	2022-11-17 오후 4:14	파일 폴더	
test	2022-11-17 오후 4:14	파일 폴더	
CHANGELOG.md	2022-11-17 오후 4:09	MD 파일	212KB
CODE_OF_CONDUCT.md	2022-11-13 오전 2:45	MD 파일	6KB
CONTRIBUTING.md	2022-11-17 오후 4:09	MD 파일	8KB
LICENSE.txt	2022-11-13 오전 2:45	텍스트 문서	3KB
MAINTAINERS.txt	2022-11-13 오전 2:45	텍스트 문서	1KB
Manifest.txt	2022-11-17 오후 4:09	텍스트 문서	32KB
MIT.txt	2022-11-13 오전 2:45	텍스트 문서	2KB
POLICIES.md	2022-11-13 오전 2:45	MD 파일	6KB
README.md	2022-11-17 오후 4:09	MD 파일	5KB
rubygems-update.gemspec	2022-11-17 오후 4:09	GEMSPEC 파일	2KB
setup.rb	2022-11-13 오전 2:45	Ruby File	1KB
UPGRADING.md	2022-11-13 오전 2:45	MD 파일	1KB



IG Publisher Installation (7)

- **Step 4 – RubyGems 설치 확인**
 - 명령프롬프트에서 아래 커맨드입력



```
gem -v
```

- Example



```
C:\Users\pebble>gem -v
3.3.7
C:\Users\pebble>
```

IG Publisher Installation (8)

- **Step 5 – jekyll 설치**

- 명령프롬프트에서 아래 커맨드입력

```
gem install bundler jekyll
```

- Example



```
C:\> 명령 프롬프트
Microsoft Windows [Version 10.0.19044.1889]
(c) Microsoft Corporation. All rights reserved.

C:\Users\pebble>gem install bundler jekyll
Successfully installed bundler-2.3.26
Parsing documentation for bundler-2.3.26
Done installing documentation for bundler after 1 seconds
Temporarily enhancing PATH for MSYS/MINGW...
Building native extensions. This could take a while...
Successfully installed sassc-2.4.0
Successfully installed jekyll-sass-converter-2.2.0
Successfully installed concurrent-ruby-1.1.10
Successfully installed i18n-1.12.0

Parsing documentation for addressable-2.8.1
Installing ri documentation for addressable-2.8.1
Parsing documentation for jekyll-4.3.1
Installing ri documentation for jekyll-4.3.1
Done installing documentation for sassc, jekyll-sass-converter, concurrent-ruby, i18n, http_parser.rb, eventmachine, em-websocket, colorator, public_suffix, addressable, jekyll after 26 seconds
12 gems installed

C:\Users\pebble>
```

IG Publisher Installation (7)

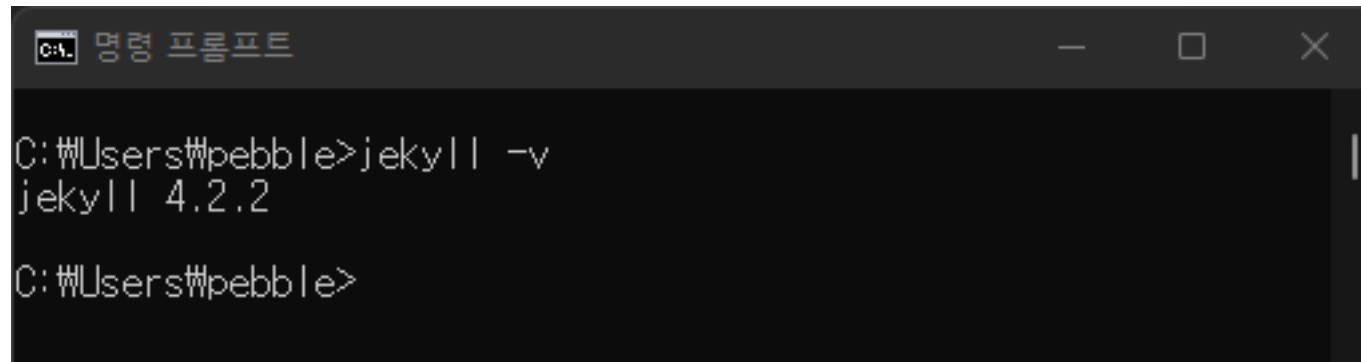
- **Step 6 – jekyll 설치**

- 명령프롬프트에서 아래 커맨드입력

A terminal window with a black background and white text. The command 'jekyll -v' is entered at the prompt. The window has a title bar with a close button (X) on the right.

```
jekyll -v
```

- Example

A Windows Command Prompt window titled '명령 프롬프트' (Command Prompt). The command 'jekyll -v' is entered, and the output 'jekyll 4.2.2' is displayed. The prompt is 'C:\Users\pebble>'.

```
C:\Users\pebble>jekyll -v
jekyll 4.2.2
C:\Users\pebble>
```

IG Publisher Installation (10)

- 명령프롬프트에서 아래 커맨드입력

※ 반드시 `kr_fsh_tutorial` 폴더 위치에서 입력

```
C:\...\kr_fsh_tutorial>_updatePublisher.bat
```

- Example

```
명령 프롬프트
C:\Users\pebble\Desktop\교육자료\IGTutorial>_updatePublisher.bat

Checking internet connection...
104.196.166.17의 응답: 바이트=32 시간=199ms TTL=118
We're online

IG Publisher is not yet in input-cache or parent folder.
Ok? (Y/N) y
Will place publisher jar here: C:\Users\pebble\Desktop\교육자료\IGTutorial\input-cache\publisher.jar
Downloading most recent publisher to Input Cache - it's ~100 MB, so this may take a bit

Updating scripts
Update scripts? (Y/N) y
Updating _updatePublisher
Updating _genonce.bat
Updating _gencontinuous.bat
Updating _genonce.sh
Updating _gencontinuous.sh
Updating _updatePublisher.bat
```

Final Check (1)

- 명령프롬프트에서 아래 커맨드입력

※ 반드시 `kr_fsh_tutorial` 폴더 위치에서 입력

```
C:\...\kr_fsh_tutorial>_genonce
```

- Example

```
명령 프롬프트 - _genonce
C:\Users\pebble\Desktop\교육자료\IGTutorial>_genonce
Checking internet connection...
104.196.166.17의 응답: 바이트=32 시간=209ms TTL=118
We're online
Picked up JAVA_TOOL_OPTIONS: -Dfile.encoding=UTF-8
FHIR IG Publisher Version 1.2.19 (Git# 1246717f1140). Built 2022-11-22T15:06:25.347Z (25 hours old)
Detected Java version: 17.0.3.1 from C:\Program Files\Java\jdk-17.0.3.1 (default) on Windows 11/amd64
(64bit). 3932MB available

Errors: 0, Warnings: 6, Info: 0, Broken Links: 0 (00:50.452)
Finished (00:50.455)
Done. This IG has been built using the 'normal' process for local use. If building to host on an an ex
ternal website, use the process documented here: https://confluence.hl7.org/display/FHIR/Maintaining+a
+FHIR+IG+Publication) (00:50.456)
계속하려면 아무 키나 누르십시오 . . .
```

Final Check (2)

<Project Structure>

```
kr_fsh_tutorial
├── fsh-generated New!
│   └── ...
├── input
│   ├── fsh
│   │   ├── MyPatient.fsh
│   │   ├── MyObservation.fsh
│   │   └── MyObsValueSet.fsh
│   ├── images
│   │   └── ...
│   ├── pagecontent
│   │   └── ...
│   └── ignoreWarnings.txt
├── input-cache New!
│   └── ...
├── output New!
│   └── ...
├── tutorial-template
│   └── ...
├── _genonce.bat
├── _updatePublisher.bat
├── ig.ini
└── sushi-config.yaml
```

• 새로 생성된 폴더들 확인

- ... \kr_fsh_tutorial\fsh-generated
 - sushi 실행 결과로 fsh 파일에서 변환/생성된 json 형식의 FHIR 리소스들이 위치
- ... \kr_fsh_tutorial\input-cache
 - IG Publisher 실행 파일(publisher.jar)이 위치
 - 이 밖에 IG Publisher 실행 시 생성되는 캐시 파일들이 위치
- ... \kr_fsh_tutorial\output
 - IG Publisher 실행 결과로 생성된 웹 리소스들이 위치

Final Check (3)

웹브라우저로 ... \kr_fsh_tutorial\output\index.html 열기

Implementation Guide Tutorial
0.1.0 - ci-build


IG Home | Table of Contents | Artifacts Summary | Other Resources ▾

Table of Contents > Home

Implementation Guide Tutorial - Local Development build (v0.1.0). See the [Directory of published versions](#) ↗

1 Home

Official URL: http://example.org/fhir/healthall-tutorial/ImplementationGuide/profiling-exercise	Version: 0.1.0
Draft as of 2022-11-24	Computable Name: IGTutorial



Total Health & Wellness IT Systems

HealthAll

본 프로젝트는 FHIR Shorthand와 Sushi, IG Publisher를 사용하여 FHIR Resource 프로파일들과 Implementation Guide를 생성하기 위한 튜토리얼 프로젝트입니다.

- Background
- FHIR Shorthand Resources
- Contact

1.1 Background

1.2 FHIR Shorthand Resources

- [HL7 Confluence site](#) ↗
- [FHIR Shorthand Documentation](#) ↗
- [FHIR Shorthand documentation code repository](#) ↗
- [SUSHI code repository](#) ↗
- [Zulip](#) ↗ channel: #shorthand

1.3 Contact

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IG © 2022+ HealthAll Inc. ↗. Package profiling-exercise#0.1.0 based on [FHIR 4.0.1](#) ↗. Generated 2022-11-24

Links: [Table of Contents](#) | [QA Report](#)

congratulations!

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C:\READY TO GO>_

Profiling Tutorial

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- Changing Cardinality
- ValueSet Binding
- Slicing

Changing Cardinality – What is Cardinality?

<Patient Resource Structure>

Structure			
Name	Flags	Card.	Type
Patient	N		DomainResource
identifier	Σ	0..*	Identifier
active	?! Σ	0..1	boolean
name	Σ	0..*	HumanName
telecom	Σ	0..*	ContactPoint
gender	Σ	0..1	code
birthDate	Σ	0..1	date
deceased[x]	?! Σ	0..1	
deceasedBoolean			boolean
deceasedDateTime			dateTime
address	Σ	0..*	Address
maritalStatus		0..1	CodeableConcept

• Cardinality

- 관계 수
- 엘리먼트의 최소/최대 사용 횟수 정의
- min..max
 - min : 0 or 1
 - max : 1 ~ *
- 선택사항 엘리먼트
 - 0..n
- 필수 엘리먼트
 - 1..1 or 1..*
- 사용금지 엘리먼트
 - 0..0
- Profiling 과정에서 Cardinality 변경을 통해 Optionality 조정가능

Changing Cardinality – Constraints

- Allowed Changes

<div>derived</div> <div>base</div>	0..0 (Not used)	0..1 (Optional)	0..n (Optional, Many)	1..1 (Required)	1..n (At least 1)
0..1	yes	-	no	yes	no
0..*	yes	yes	yes	yes	yes
1..1 (fixed)	no	no	no	-	no
1..*	no	no	no	yes	yes

Changing Cardinality – Exercise Goal

- 실습 목표

- Patient 리소스의 gender 엘리먼트의 최소 사용 횟수를 1로 상향
 - Patient.gender 0..* → 1..*
 - 반드시 환자 성별을 사용하도록 강제
- +@ Patient.gender의 설명을 '환자 성별'로 수정

<Patient Resource Structure (AS-IS)>

Structure				
Name	Flags	Card.	Type	
Patient	N		DomainResource	
identifier	Σ	0..*	Identifier	
active	?! Σ	0..1	boolean	
name	Σ	0..*	HumanName	
telecom	Σ	0..*	ContactPoint	
gender	Σ	0..1	code	

<MyPatient Resource Structure (TO-BE)>

Name	Flags	Card.	Type	Description & Constraints
Patient		0..*	Patient	Information about an individual
gender		1..1	code	환자 성별

Changing Cardinality – FSH (1)

MyPatient.fsh

Profile: MyPatient

Parent: Patient

Id: profilingtutorial-mypatient

Title: "MyPatient"

Description: "Profiling Tutorial을 위해 작성한 Patient Profile"

* gender 1.. // (== 1..1)

* gender ^short = "환자 성별"

Profile: {프로파일 명}

Parent : {프로파일링할 리소스}

* <element> {min}..{max}

* <element> ^<element of ElementDefinition> = {value}

Changing Cardinality – FSH (2)

<ElementDefinition Structure>

Structure				
Name	Flags	Card.	Type	Description & Constraints
ElementDefinition	Σ N		Element	Definition of an element in a resource or extension + Rule: Min ≤ Max + Rule: if the element definition has a contentReference, it cannot have a
path	Σ	1..1	string	Elements defined in Ancestors: id, extension, modifierExtension Path of the element in the hierarchy of elements
representation	Σ	0..*	code	xmlAttr xmlText typeAttr cdaText xhtml PropertyRepresentation (Required)
sliceName	Σ	0..1	string	Name for this particular element (in a set of slices)
sliceIsConstraining	Σ TU	0..1	boolean	If this slice definition constrains an inherited slice definition (or not)
label	Σ	0..1	string	Name for element to display with or prompt for element
code	Σ	0..*	Coding	Corresponding codes in terminologies ElementDefinitionCode (Example)
slicing	Σ	0..1	Element	This element is sliced - slices follow
discriminator	Σ	0..*	Element	Element values that are used to distinguish the slices
type	Σ	1..1	code	value exists pattern type profile position DiscriminatorType (Required)
path	Σ	1..1	string	Path to element value
description	Σ	0..1	string	Text description of how slicing works (or not)
ordered	Σ	0..1	boolean	If elements must be in same order as slices
rules	Σ	1..1	code	closed open openAtEnd SlicingRules (Required)
short	Σ	0..1	string	Concise definition for space-constrained presentation
definition	Σ	0..1	markdown	Full formal definition as narrative text
comment	Σ	0..1	markdown	Comments about the use of this element

• ElementDefinition

• <http://hl7.org/fhir/r4/elementdefinition.html>

• 엘리먼트를 정의하는 정보들

* gender ^short = "환자 성별"

• Patient.gender의 short 값을 재정의

• short Σ 0..1 string Concise definition for space-constrained presentation

Changing Cardinality – sushi

- 명령프롬프트에서 아래 커맨드입력

※ 반드시 `kr_fsh_tutorial` 폴더 위치에서 입력

```
C:\...\kr_fsh_tutorial>sushi .
```

- Example

```
C:\Users\pebble\Desktop\교육자료\IGTutorial>sushi .
info Running SUSHI v2.7.0 (implements FHIR Shorthand specification v2.0.0)
info Arguments:
info
```

SUSHI RESULTS

Profiles	Extensions	Logicals	Resources
3	0	0	0

ValueSets	CodeSystems	Instances
0	0	0

Valedictorian of the School of FSH! 0 Errors 0 Warnings

Changing Cardinality – _genonce

- 명령프롬프트에서 아래 커맨드입력

※ 반드시 `kr_fsh_tutorial` 폴더 위치에서 입력

```
C:\...\kr_fsh_tutorial>_genonce
```

- Example

```
명령 프롬프트 - _genonce
C:\Users\pebble\Desktop\교육자료\IGTutorial>_genonce
Checking internet connection...
104.196.166.17의 응답: 바이트=32 시간=209ms TTL=118
We're online
Picked up JAVA_TOOL_OPTIONS: -Dfile.encoding=UTF-8
FHIR IG Publisher Version 1.2.19 (Git# 1246717f1140). Built 2022-11-22T15:06:25.347Z (25 hours old)
Detected Java version: 17.0.3.1 from C:\Program Files\Java\jdk-17.0.3.1 (default) on Windows 11/amd64
(64bit). 3932MB available

Errors: 0, Warnings: 6, Info: 0, Broken Links: 0 (00:50.452)
Finished (00:50.455)
Done. This IG has been built using the 'normal' process for local use. If building to host on an external website, use the process documented here: https://confluence.hl7.org/display/FHIR/Maintaining+a
+FHIR+IG+Publication) (00:50.456)
계속하려면 아무 키나 누르십시오 . . .
```

Changing Cardinality – Differential Table in IG

- C:\W...Wkr_fsh_tutorial\output\index.html
→ Artifact Summary → MyPatient

Differential Table					Key Elements Table	Snapshot Table	Statistics/References	All
This structure is derived from Patient								
Name	Flags	Card.	Type	Description & Constraints				
 Patient		0..*	Patient	Information about an individual or animal receiving health care services				
 gender		1..1	code	환자 성별				
 Documentation for this format								

Changing Cardinality – JSON vs FSH

StructureDefinition-profilingtutorial-mypatient.json

```
{
  "resourceType": "StructureDefinition",
  "id": "profilingtutorial-mypatient",
  "extension": [
    {
      "url": "http://hl7.org/fhir/StructureDefinition/structuredefinition-category",
      "valueString": "Base.Individuals"
    },
    {
      "url": "http://hl7.org/fhir/StructureDefinition/structuredefinition-security-category",
      "valueCode": "patient"
    }
  ],
  "url": "http://example.org/fhir/healthall-tutorial/StructureDefinition/profilingtutorial-mypatient",
  "version": "0.1.0",
  "name": "MyPatient",
  "title": "MyPatient",
  "status": "active",
  "description": "Profiling Tutorial을 위해 작성한 Patient Profile",
  "fhirVersion": "4.0.1",
  "mapping": [
    {
      "identity": "rim",
      "uri": "http://hl7.org/v3",
      "name": "RIM Mapping"
    },
    {
      "identity": "cda",
      "uri": "http://hl7.org/v3/cda",
      "name": "CDA (R2)"
    },
    {
      "identity": "w5",
      "uri": "http://hl7.org/fhir/fivews",
      "name": "FiveWs Pattern Mapping"
    }
  ],
```

```
{
  "identity": "v2",
  "uri": "http://hl7.org/v2",
  "name": "HL7 v2 Mapping"
},
{
  "identity": "loinc",
  "uri": "http://loinc.org",
  "name": "LOINC code for the element"
}
],
"kind": "resource",
"abstract": false,
"type": "Patient",
"baseDefinition": "http://hl7.org/fhir/StructureDefinition/Patient",
"derivation": "constraint",
"differential": {
  "element": [
    {
      "id": "Patient.gender",
      "path": "Patient.gender",
      "short": "환자 성별",
      "min": 1
    }
  ]
}
}
```

VS

MyPatient.fsh

```
Profile: MyPatient
Parent: Patient
Id: profilingtutorial-mypatient
Title: "MyPatient"
Description: "Profiling Tutorial을 위해 작성한 Patient Profile"
* gender 1.. // (== 1..*)
* gender ^short = "환자 성별"
```

ValueSet Binding – What is ValueSet?

- CodeSystem
 - 코드 체계
 - ex) LOINC, SNOMED-CT, MDC(11073-10101)
- Code
 - 개념을 코드화 시킨 것
 - ex) Code: 85354-9
Display: Blood pressure panel with all children optional
CodeSystem: LOINC
- ValueSet
 - 하나 이상의 코드 체계의 부분 집합
- ValueSet Binding
 - 코드 값을 사용하는 엘리먼트에 사용할 ValueSet을 묶어두는 것

ValueSet Binding – Binding Strength

- Binding Strength
 - required - ValueSet 내 코드만 사용할 수 있음
 - extensible - ValueSet 내 코드 + 그 외 코드 사용 가능
 - 단, 기본 ValueSet 내 코드와 의미가 겹치는 다른 코드는 사용 불가능
 - preferred - ValueSet 내 코드 사용 선호
 - example - 코드 사용 예로 ValueSet을 제시한 것

<Identifier>

Name	Flags	Card.	Type	Description & Constraints
Identifier	Σ N		Element	An identifier intended for computation
use	?! Σ	0..1	code	Elements defined in Ancestors: id , extension usual official temp secondary old (If known) IdentifierUse (Required)
type	Σ	0..1	CodeableConcept	Description of Identifier Identifier Type Codes (Extensible)
system	Σ	0..1	uri	The namespace for the identifier value
value	Σ	0..1	string	The value that is unique
period	Σ	0..1	Period	Time period when id is/was valid for use
assigner	Σ	0..1	Reference(Organization)	Organization that issued id (may be just text)

- Allowed Changes

base \ derived	required	extensible	preferred	example
required	yes	no	no	no
extensible	yes	yes	no	no
preferred	yes	yes	yes	no
example	yes	yes	yes	yes

ValueSet Binding – Exercise Goal

- 실습 목표
 - Observation.code에 ValueSet 바인딩
 - Tutorial Project 내 MyObsCodeSystem, MyObsValueSet 사용

<Observation Resource Structure (AS-IS)>

Name	Flags	Card.	Type	Description & Constraints
Observation	I N		DomainResource	Measurements and simple assertions + Rule: dataAbsentReason SHALL only be + Rule: If Observation.code is the same as
code	Σ	1..1	CodeableConcept	Type of observation (code / type) LOINC Codes (Example)



<MyObservation Resource Structure (TO-BE)>

Name	Flags	Card.	Type	Description & Constraints
Observation		0..*	Observation	Measurements and simple assertions
code		1..1	CodeableConcept	생체징후 측정 코드 Binding: Observation Codes for Tutorial (extensible): Observation Codes for Tutorial
coding		0..*	Coding	정의된 코드
system		1..1	uri	코드체계 식별자
code		1..1	code	코드값
display		0..1	string	코드명칭

CodeSystem – FSH

MyObsCodeSystem.fsh

```
CodeSystem: MyObsCodeSystem
Id: profilingtutorial-myobscodesystem
Title: "Observation CodeSystem for Tutorial"
Description: "Profiling Tutorial을 위해 작성한 CodeSystem"
* ^experimental = false
* ^caseSensitive = false
* ^content = #complete

* #heart_rate "심박수"
* #body_temperature "체온"
* #sp_o2 "산소포화도"
* #blood_pressure "혈압"
* #body_weight "체중"
* #body_height "신장"
```

```
* #{code} "{display string}"
```

ValueSet – FSH

MyObsValueSet.fsh

```
ValueSet: MyObsValueSet  
Id: profilingtutorial-myobsvalueset  
Title: "Observation ValueSet for Tutorial"  
Description: "Profiling Tutorial을 위해 작성한 ValueSet"
```

```
* include MyObsCodeSystem#heart_rate  
* include MyObsCodeSystem#body_temperature  
* include MyObsCodeSystem#sp_o2  
* include MyObsCodeSystem#blood_pressure  
* include MyObsCodeSystem#body_weight  
* include MyObsCodeSystem#body_height "키"
```

```
* include {Coding}
```


ValueSet Binding – FSH

MyObservation.fsh

```
Profile: MyObservation
Parent: Observation
Id: profilingtutorial-myobservation
Title: "MyObservation"
Description: "Profiling Tutorial을 위해 작성한 Observation Profile"
* code ^short = "생체징후 측정 코드"
* code from MyObsValueSet (extensible)
* code ^binding.description = "Observation Codes for Tutorial"
* code.coding ^short = "정의된 코드"
* code.coding.system 1..
* code.coding.system ^short = "코드체계 식별자"
* code.coding.code 1..
* code.coding.code ^short = "코드값"
* code.coding.display ^short = "코드명칭"
```

```
* <bindable element> from {ValueSet} ({strength})
```

ValueSet Binding – Differential Table in IG

- C:\W...Wkr_fsh_tutorial\output\index.html
→ Artifact Summary → MyObservation

Name	Flags	Card.	Type	Description & Constraints
Observation		0..*	Observation	Measurements and simple assertions
code		1..1	CodeableConcept	생체징후 측정 코드 Binding: Observation Codes for Tutorial (extensible): Observation Codes for Tutorial
coding		0..*	Coding	정의된 코드
system		1..1	uri	코드체계 식별자
code		1..1	code	코드값
display		0..1	string	코드명칭

<MyObsValueSet>

2.3.1.1 Logical Definition (CLD)

- Include these codes as defined in <http://example.org/fhir/healthall-tutorial/CodeSystem/profilingtutorial-myobscodesystem>

Code	Display
heart_rate	심박수
body_temperature	체온
sp_o2	산소포화도
blood_pressure	혈압
body_weight	체중
body_height	키

Slicing – What is Slicing?

- Slicing

- 여러 번 사용할 수 있는 엘리먼트의 세부 유형을 분할하여 정의

- list:Any



list:String

list:Integer

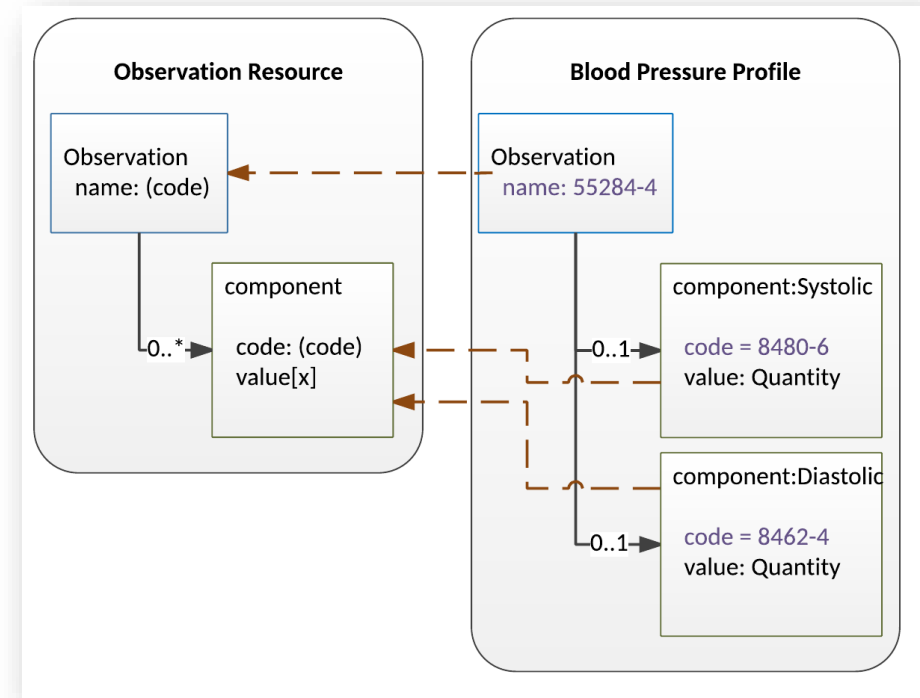
- 예) 혈압 측정 결과

- 혈압 측정시
최대 혈압(Systolic)과
최소 혈압(Diastolic)이
동시에 측정됨
- component를
component:Systolic
component:Diastolic
두 개의 유형으로 정의

<Observation Resource Structure>

Name	Flags	Card.
Observation	I N	
component	Σ	0..*
code	Σ	1..1
value[x]	Σ	0..1
valueQuantity		
valueCodeableConcept		
valueString		
valueBoolean		
valueInteger		
valueRange		
valueRatio		
valueSampledData		
valueTime		
valueDateTime		
valuePeriod		
dataAbsentReason	I	0..1
interpretation		0..*
referenceRange		0..*

<Slicing>



Slicing – parameters

- discriminator.path
 - FhirPath
 - 슬라이싱 기준 엘리먼트의 위치를 설명
- discriminator.type
 - value | exists | pattern | type | profile*
 - 슬라이싱 기준. 어떤 기준으로 원본과 차별화를 할 것인가?
- rules
 - closed | open | openAtEnd*
 - 엘리먼트를 기본 정의(default slicing) 대로 사용하는 것을 허용할 것인지?
 - + 프로파일에서 정의한 슬라이싱 외에 다른 슬라이싱을 허용할 것인지?
- ordered (default: false)
 - true or false
 - 프로파일에서 정의한 슬라이싱의 순서대로 사용하도록 강제할 것인지?

<ElementDefinition Structure>

Structure			
Name	Flags	Card.	Type
ElementDefinition	Σ N		Element
<hr/>			
slicing	Σ	0..1	Element
discriminator	Σ	0..*	Element
type	Σ	1..1	code
path	Σ	1..1	string
description	Σ	0..1	string
ordered	Σ	0..1	boolean
rules	Σ	1..1	code

Slicing – Exercise Goal

- 실습 목표

- Observation.componentet를 Systolic과 Diastolic으로 슬라이싱

<Patient Resource Structure (AS-IS)>

Name	Flags	Card.
Observation	I N	
component	Σ	0..*
code	Σ	1..1
value[x]	Σ	0..1
valueQuantity		
valueCodeableConcept		
valueString		
valueBoolean		
valueInteger		
valueRange		
valueRatio		
valueSampledData		
valueTime		
valueDateTime		
valuePeriod		
dataAbsentReason	I	0..1
interpretation		0..*
referenceRange		0..*

<MyPatient Resource Structure (TO-BE)>

Name	Flags	Card.	Type	Description & Constraints
Observation		0..*	Observation	Measurements and simple assertions
Slices for component		1..*	BackboneElement	혈압 측정 결과. Slice: Unordered, Open by value:code.coding.code
component:Systolic		0..1	BackboneElement	수축기 혈압 측정.
code				
coding				
system		0..1	uri	Identity of the terminology system Fixed Value: urn:iso:std:iso:11073:10101
code		1..1	code	Symbol in syntax defined by the system Fixed Value: 150021
value[x]		0..1	Quantity	Actual component result
value		1..1	decimal	Numerical value (with implicit precision)
system		1..1	uri	System that defines coded unit form Fixed Value: http://unitsofmeasure.org
code		1..1	code	Coded form of the unit Fixed Value: mm[Hg]
component:Diastolic		0..1	BackboneElement	이완기 혈압 측정.
code				
coding				
system		0..1	uri	Identity of the terminology system Fixed Value: urn:iso:std:iso:11073:10101
code		1..1	code	Symbol in syntax defined by the system Fixed Value: 150022
value[x]		0..1	Quantity	Actual component result
value		1..1	decimal	Numerical value (with implicit precision)
system		1..1	uri	System that defines coded unit form Fixed Value: http://unitsofmeasure.org
code		1..1	code	Coded form of the unit Fixed Value: mm[Hg]

Slicing – FSH (1)

MyObservation.fsh

Profile: MyObservation

Parent: Observation

/* 생략... */

```
* component 1..
* component ^short = "혈압 측정 결과."
* component ^slicing.discriminator.type = #value
* component ^slicing.discriminator.path = "code.coding.code"
* component ^slicing.rules = #open
* component contains
  Systolic 0..1 and
  Diastolic 0..1
// Systolic: 수축기
* component[Systolic] ^short = "수축기 혈압 측정."
* component[Systolic].code.coding.system = "http://loinc.org" (exactly)
* component[Systolic].code.coding.code 1..1
* component[Systolic].code.coding.code = #8480-6 (exactly)
* component[Systolic].value[x] only Quantity
* component[Systolic].value[x].value 1..1
* component[Systolic].value[x].system 1..1
* component[Systolic].value[x].system = "http://unitsofmeasure.org" (exactly)
* component[Systolic].value[x].code 1..1
* component[Systolic].value[x].code = #mm[Hg] (exactly)
// Diastolic: 이완기
* component[Diastolic] ^short = "이완기 혈압 측정."
* component[Diastolic].code.coding.system = "http://loinc.org" (exactly)
* component[Diastolic].code.coding.code 1..1
* component[Diastolic].code.coding.code = #8462-4 (exactly)
* component[Diastolic].value[x] only Quantity
* component[Diastolic].value[x].value 1..1
* component[Diastolic].value[x].system 1..1
* component[Diastolic].value[x].system = "http://unitsofmeasure.org" (exactly)
* component[Diastolic].value[x].code 1..1
* component[Diastolic].value[x].code = #mm[Hg] (exactly)
```

- component는 반드시 1회 이상 사용되어야 함
- **Observation.component.code.coding.code**의 값(**value**)를 기준으로 슬라이싱
- component를 기본 정의 대로 사용하는 것도 허용함(**open**)
- 슬라이싱의 이름은 **Systolic**과 **Diastolic**
- Systolic과 Diastolic은 각각 최대 1회 사용가능

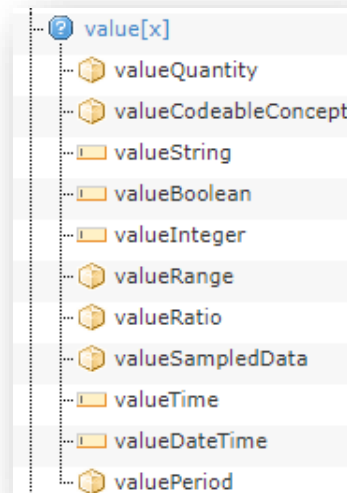
Slicing – FSH (2)

MyObservation.fsh

```
Profile: MyObservation
Parent: Observation
/* 생략... */
* component 1..
* component ^short = "혈압 측정 결과."
* component ^slicing.discriminator.type = #value
* component ^slicing.discriminator.path = "code.coding.code"
* component ^slicing.rules = #open
* component contains
  Systolic 0..1 and
  Diastolic 0..1
// Systolic: 수축기
* component[Systolic] ^short = "수축기 혈압 측정."
* component[Systolic].code.coding.system = "http://loinc.org" (exactly)
* component[Systolic].code.coding.code 1..1
* component[Systolic].code.coding.code = #8480-6 (exactly)
* component[Systolic].value[x] only Quantity
* component[Systolic].value[x].value 1..1
* component[Systolic].value[x].system 1..1
* component[Systolic].value[x].system = "http://unitsofmeasure.org" (exactly)
* component[Systolic].value[x].code 1..1
* component[Systolic].value[x].code = #mm[Hg] (exactly)
// Diastolic: 이완기
* component[Diastolic] ^short = "이완기 혈압 측정."
* component[Diastolic].code.coding.system = "http://loinc.org" (exactly)
* component[Diastolic].code.coding.code 1..1
* component[Diastolic].code.coding.code = #8462-4 (exactly)
* component[Diastolic].value[x] only Quantity
* component[Diastolic].value[x].value 1..1
* component[Diastolic].value[x].system 1..1
* component[Diastolic].value[x].system = "http://unitsofmeasure.org" (exactly)
* component[Diastolic].value[x].code 1..1
* component[Diastolic].value[x].code = #mm[Hg] (exactly)
```

- 측정 종류(Systolic)를 식별하기 위한 코드 체계는 <http://loinc.org>를 사용
- 측정 종류 식별 코드는 8480-6
- 측정 값 유형은 Quantity를 사용
 - valueQuantity: 측정 값(value)과 측정 단위(unit)로 구성

<Choice of Datatype>



<Quantity>

Quantity	Σ	I	N	Element
value	Σ		0..1	decimal
comparator	?! Σ		0..1	code
unit	Σ		0..1	string
system	Σ	I	0..1	uri
code	Σ		0..1	code

- 측정 단위를 식별하기 위한 코드 체계는 <http://unitsofmeasure.org>를 사용
- 측정 단위 식별 코드는 mm[Hg]

Slicing – Differential Table in IG

- C:\W...Wkr_fsh_tutorial\output\index.html
→ Artifact Summary → MyObservation

Name	Flags	Card.	Type	Description & Constraints
Observation		0..*	Observation	Measurements and simple assertions
Slices for component		1..*	BackboneElement	혈압 측정 결과. Slice: Unordered, Open by value:code.coding.code
component:Systolic		0..1	BackboneElement	수축기 혈압 측정.
code				
coding				
system		0..1	uri	Identity of the terminology system Fixed Value: urn:iso:std:iso:11073:10101
code		1..1	code	Symbol in syntax defined by the system Fixed Value: 150021
value[x]		0..1	Quantity	Actual component result
value		1..1	decimal	Numerical value (with implicit precision)
system		1..1	uri	System that defines coded unit form Fixed Value: http://unitsofmeasure.org
code		1..1	code	Coded form of the unit Fixed Value: mm[Hg]
component:Diastolic		0..1	BackboneElement	이완기 혈압 측정.
code				
coding				
system		0..1	uri	Identity of the terminology system Fixed Value: urn:iso:std:iso:11073:10101
code		1..1	code	Symbol in syntax defined by the system Fixed Value: 150022
value[x]		0..1	Quantity	Actual component result
value		1..1	decimal	Numerical value (with implicit precision)
system		1..1	uri	System that defines coded unit form Fixed Value: http://unitsofmeasure.org
code		1..1	code	Coded form of the unit Fixed Value: mm[Hg]

Download Package

- Package
 - StructureDefinition, CodeSystem, ValueSet, Example 등이 포함 된 압축파일
 - ... \kr_fsh_tutorial\output\package.tgz
 - 또는 index 페이지에서 다운로드 (IG 별로 다름)

1.2 Artifacts

- Examples
- Package

- 이어지는 실습에서, Package에 포함된 파일들로 FHIR Server에 IG 로드 예정



FHIR Server

with HAPI FHIR

HealthAll 책임연구원 전 형 석

목차

- **Installation**
 - Postman
 - Spring Tool Suite
- **HAPI FHIR JPA Server:**
 - Download
 - Import & Configuration
 - Run
- **FHIR Server Test (Postman)**
 - Import the tutorial collection
 - CRUDS Operation
- **Upload Tutorial IG on a FHIR Server**
 - Upload conformance resources
 - Resource instance validation against Profiles

Download & Install Postman

- <https://www.postman.com/downloads/>

Download Postman

Download the app to get started using the Postman API Platform today. Or, if you prefer a browser experience, you can try the web version of Postman.

The Postman app

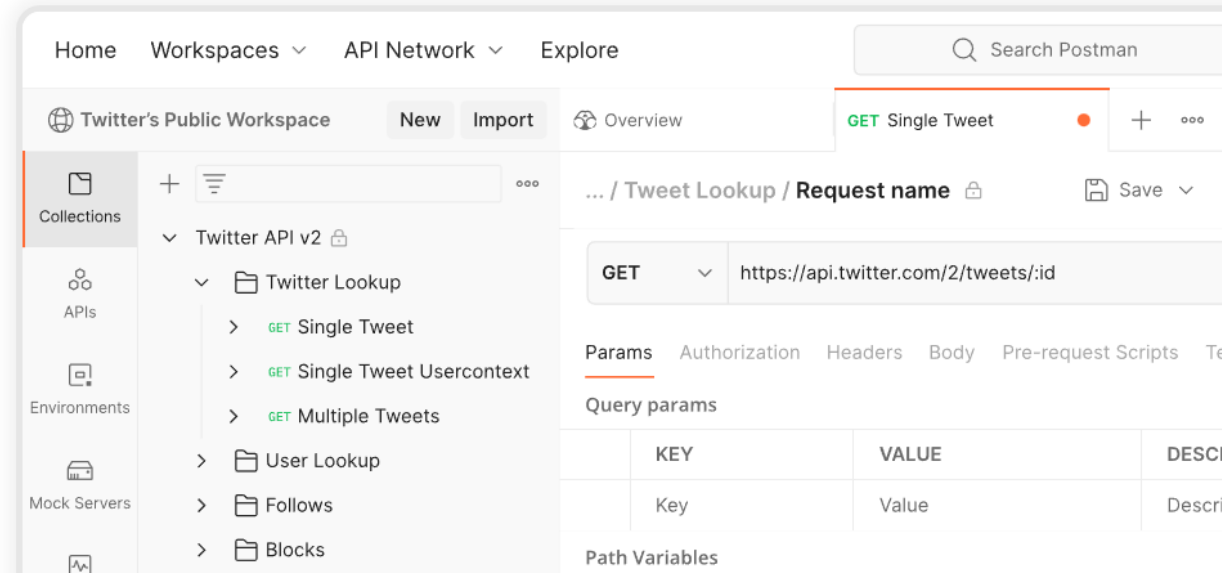
Download the app to get started with the Postman API Platform.

 Windows 64-bit

By downloading and using Postman, I agree to the [Privacy Policy](#) and [Terms](#).

[Release Notes](#) · [Product Roadmap](#)

Not your OS? Download for Mac ([Intel Chip](#) / [Apple Chip](#)) or Linux ([x64](#))



Download Spring Tool Suite (STS)

- Spring Tool Suite
 - Eclipse 기반 IDE
 - Spring Framework 기반 서버 프로그래밍에 최적화
 - 링크: <https://spring.io/tools>

Spring Tools 4 for Eclipse

The all-new Spring Tool Suite 4. Free.
Open source.

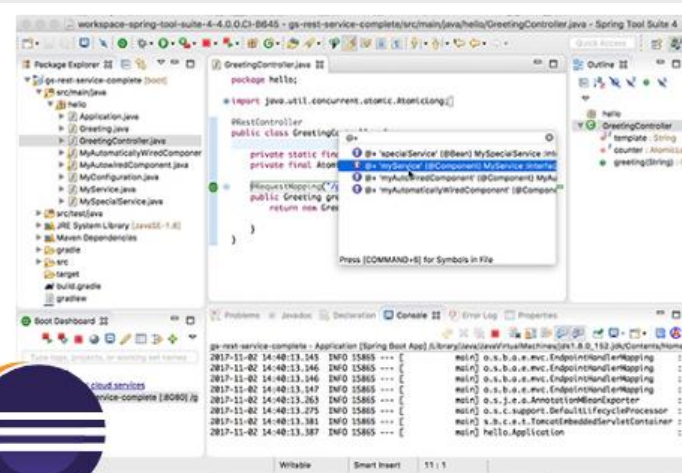
4.20.1 - LINUX X86_64

4.20.1 - LINUX ARM_64

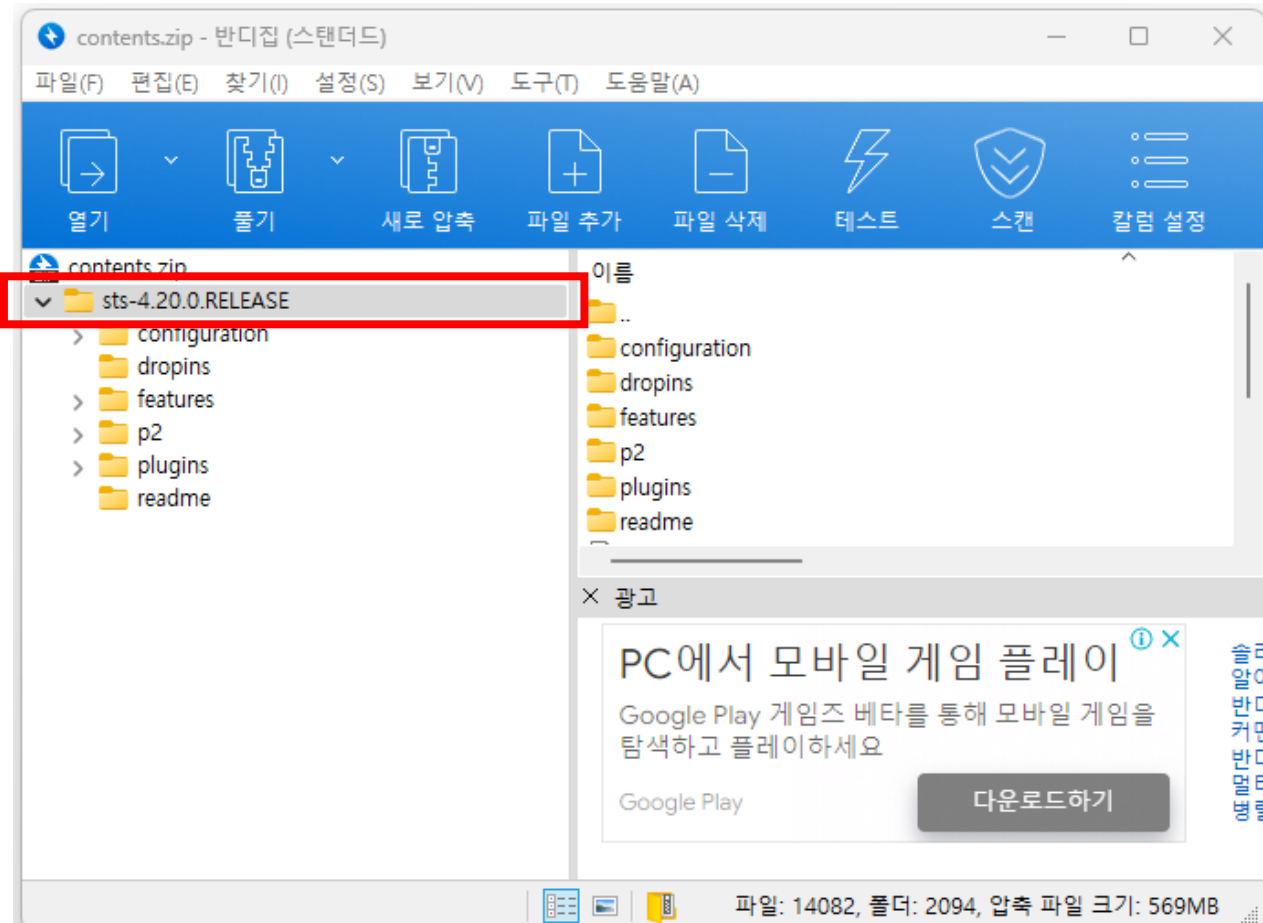
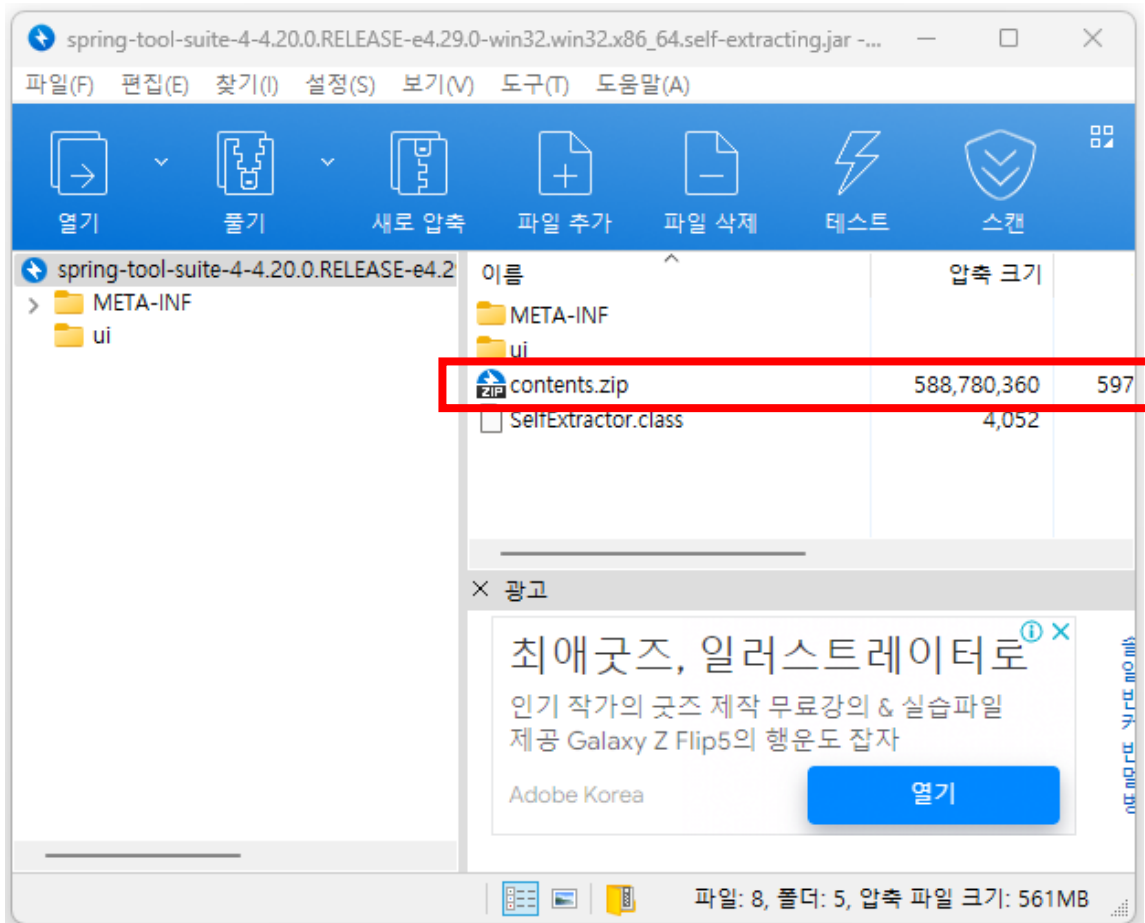
4.20.1 - MACOS X86_64

4.20.1 - MACOS ARM_64

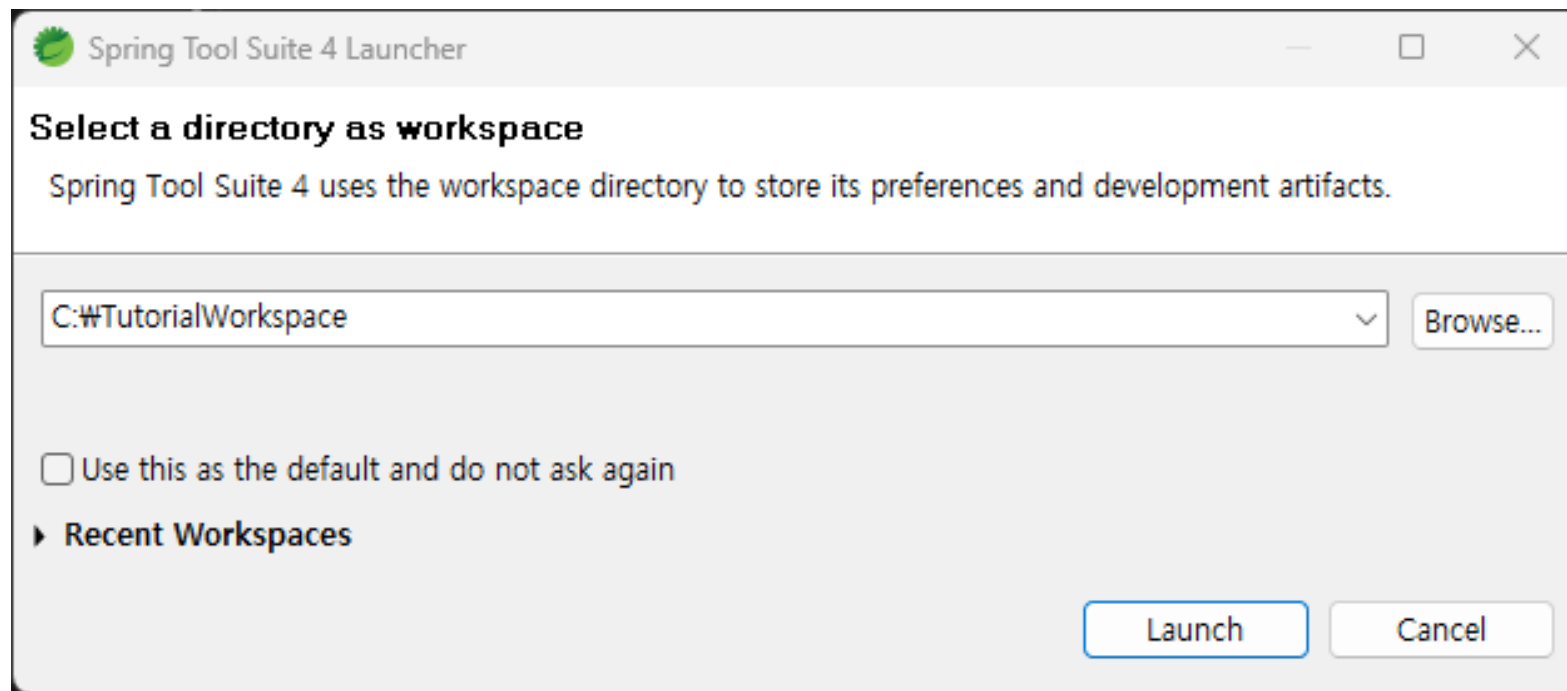
4.20.1 - WINDOWS X86_64



STS 압축 해제



STS Workspace 설정



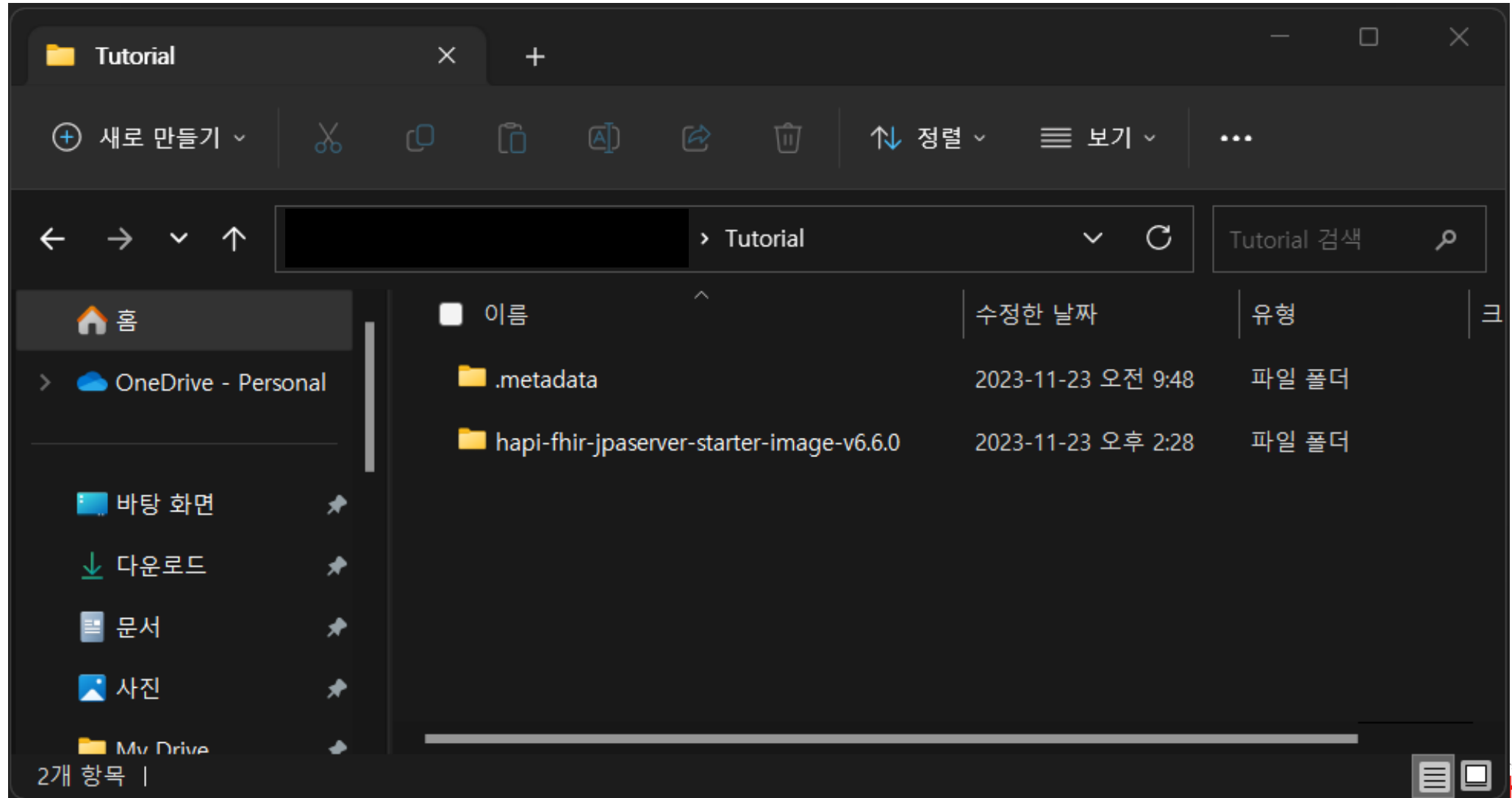
- 한글이 들어가거나 지나치게 긴 경로 사용은 가급적 피할 것

Download HAPI FHIR JPA Server

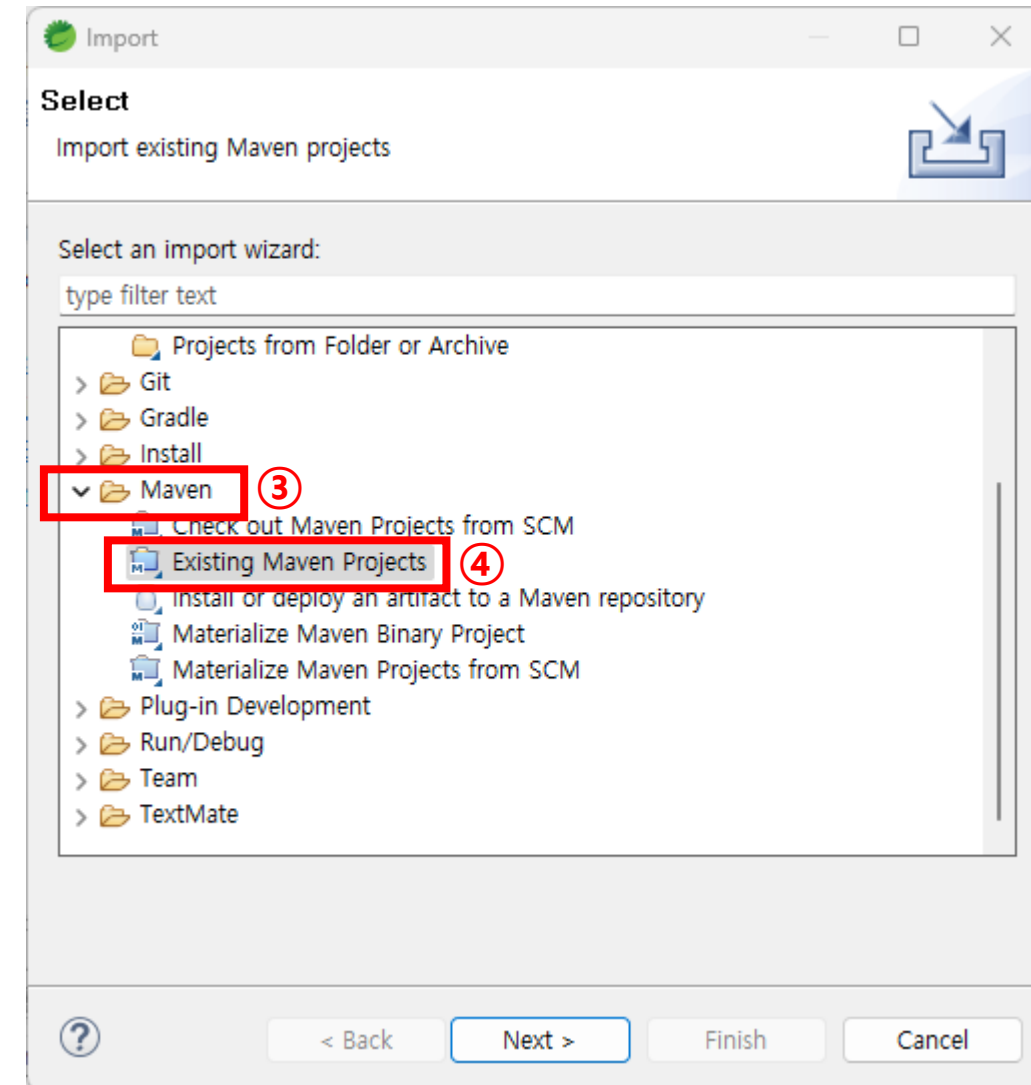
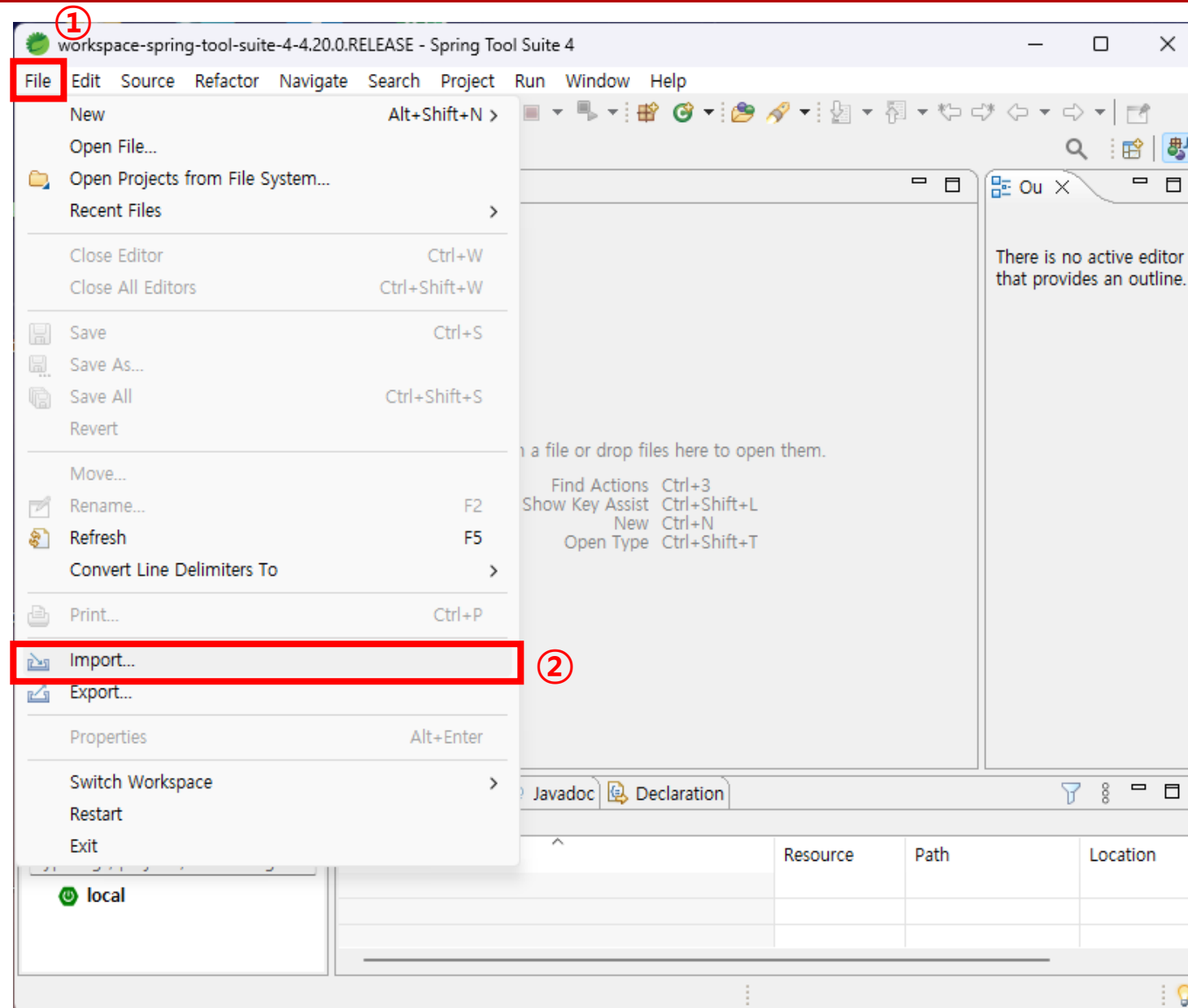
- HAPI FHIR JPA Server
 - HAPI FHIR Library, Java Persistence API 기반 FHIR Server
 - 기본적인 FHIR RESTful Operation 모두 구현됨
 - Database 포함
 - HAPI FHIR JPA Server Github Link:
 - <https://github.com/hapifhir/hapi-fhir-jpaserver-starter>
 - Download v6.6.0
 - <https://github.com/hapifhir/hapi-fhir-jpaserver-starter/archive/refs/tags/image/v6.6.0.zip>

Unzip HAPI FHIR JPA Serve

- Workspace에 hapi-fhir-jpaserver-starter-image-v6.6.0.zip 압축 풀기



HAPI FHIR JPA Server Project Import (1)



HAPI FHIR JPA Server Project Import (2)

Import Maven Projects

Maven Projects
Select Maven projects

Root Directory:

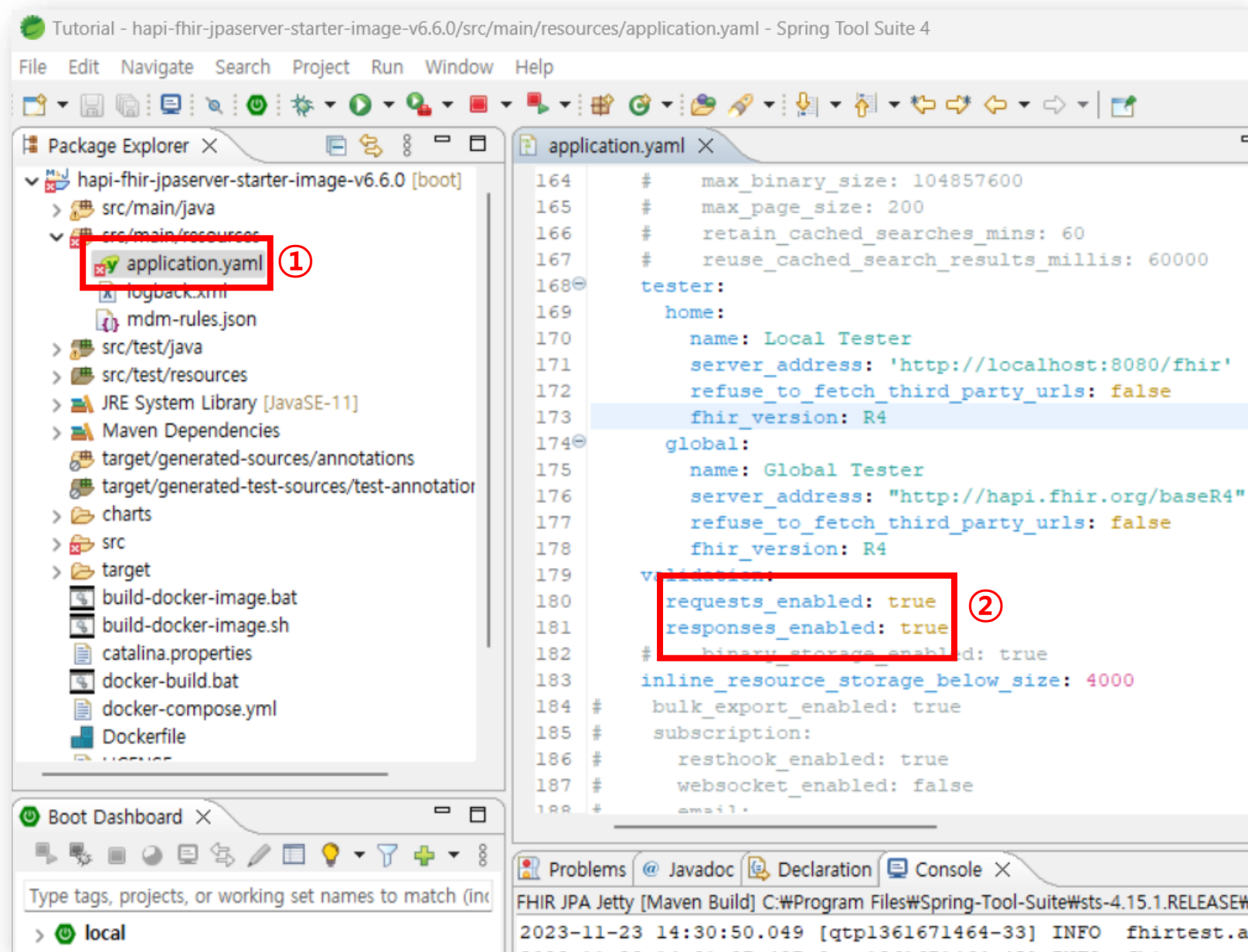
Projects:

<input checked="" type="checkbox"/> /pom.xml	ca.uhn.hapi.fhir:hapi-fhir-jpaserver-starter:6.6.0:war
--	--

☐ Add project(s) to working set

► Advanced

설정 파일 수정



- 아래 설정 주석 해제

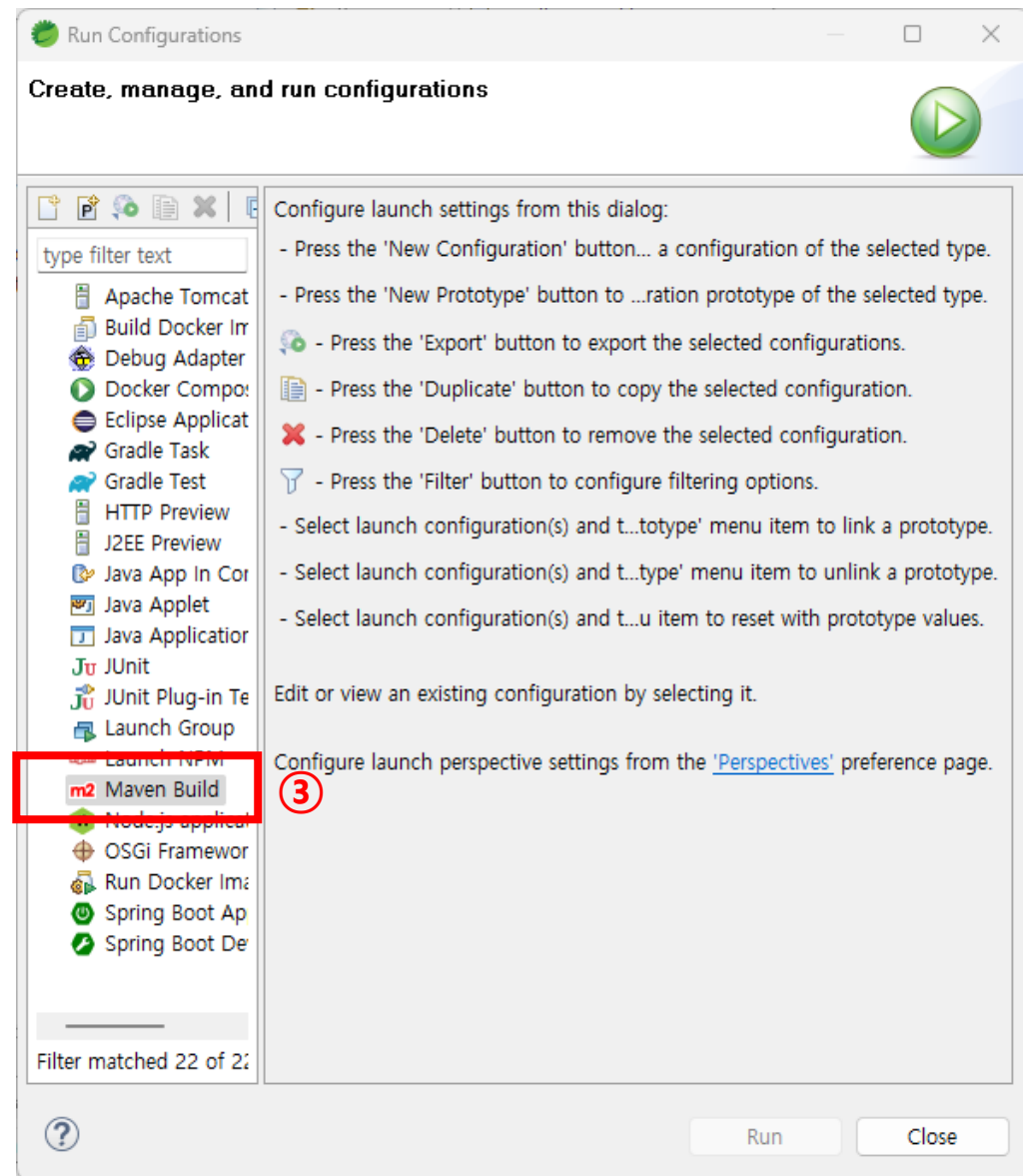
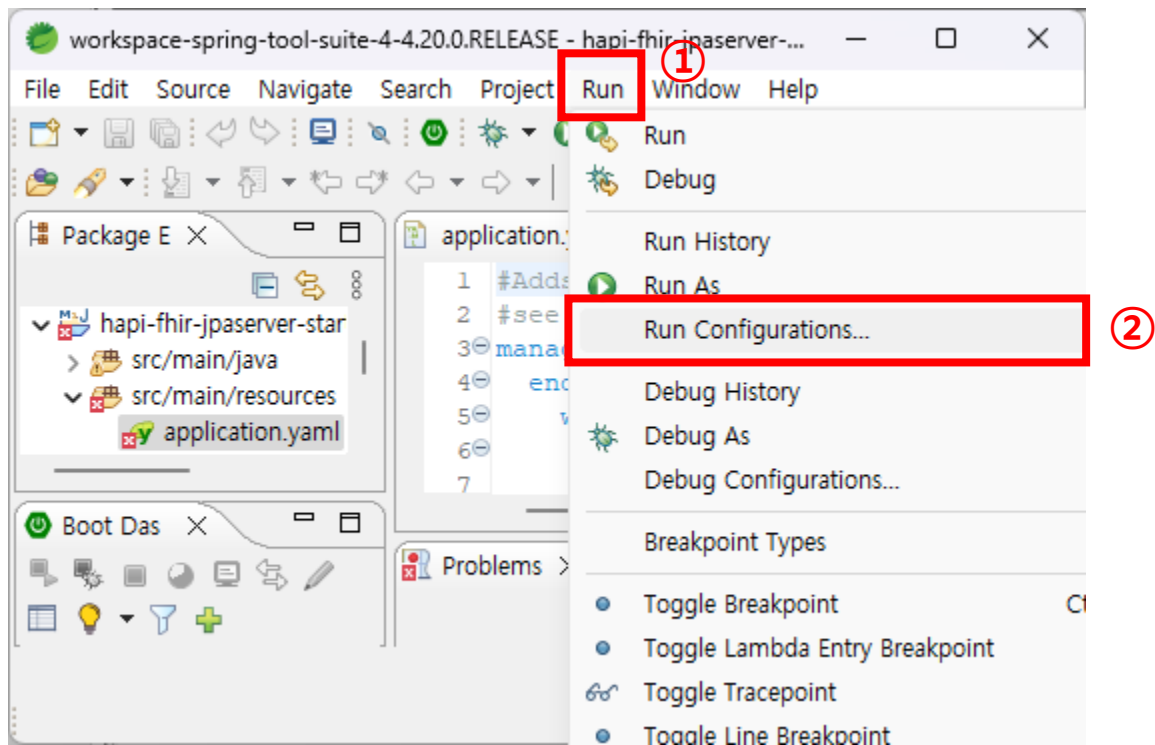
validation:

requests_enabled: true

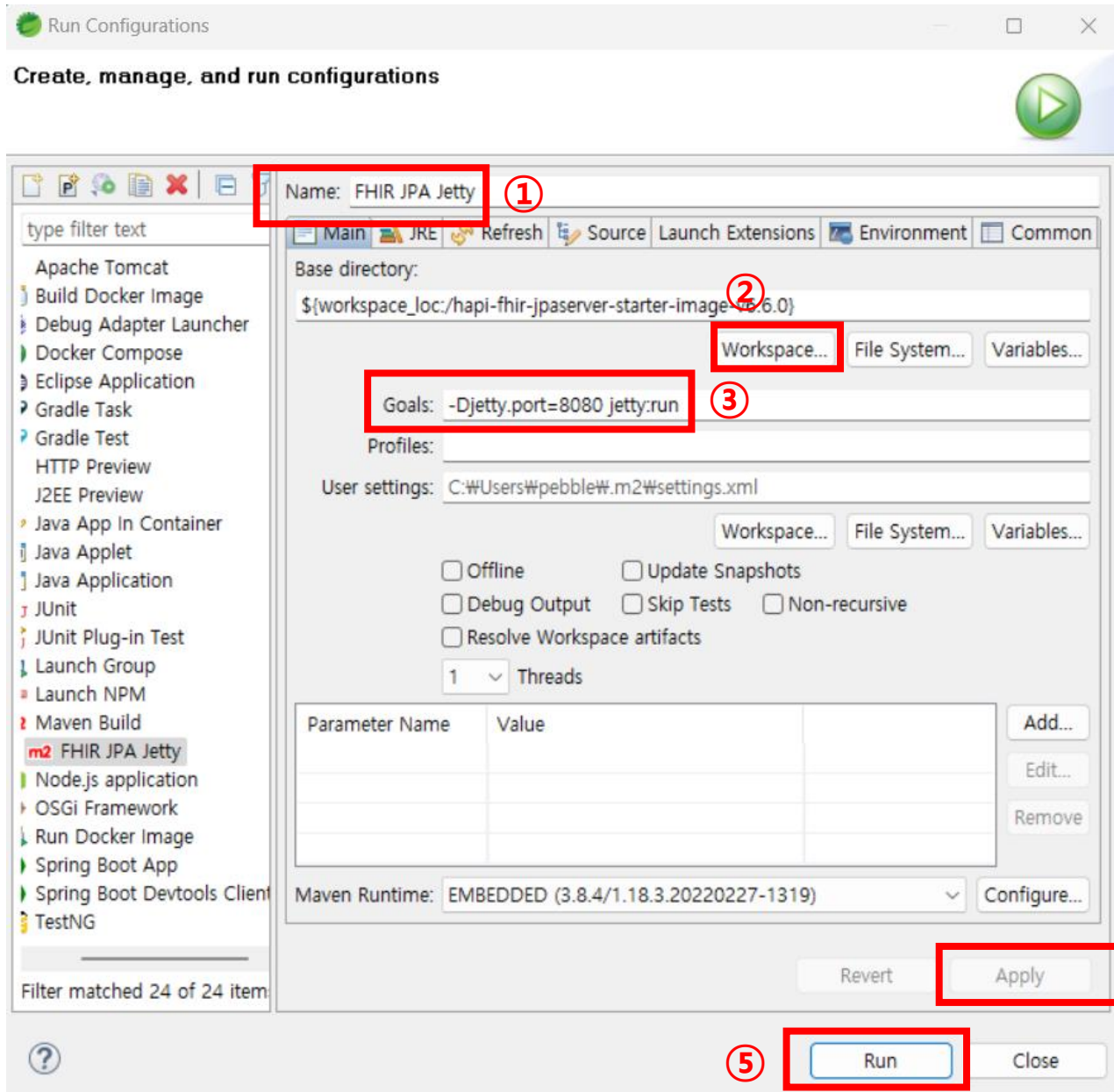
responses_enabled: true

- Indentation에 주의 할 것
- test: 설정과 동일한 hierachy로 설정

실행 설정



실행 설정



- -Djetty.port=8080 jetty:run

Get metadata

- <http://localhost:8080/fhir/metadata>

This result is being rendered in HTML for easy viewing. You may access this content as [Raw JSON](#) or [Raw XML](#) or [Raw Turtle](#) or view this content

HTTP 200 OK

Response Headers

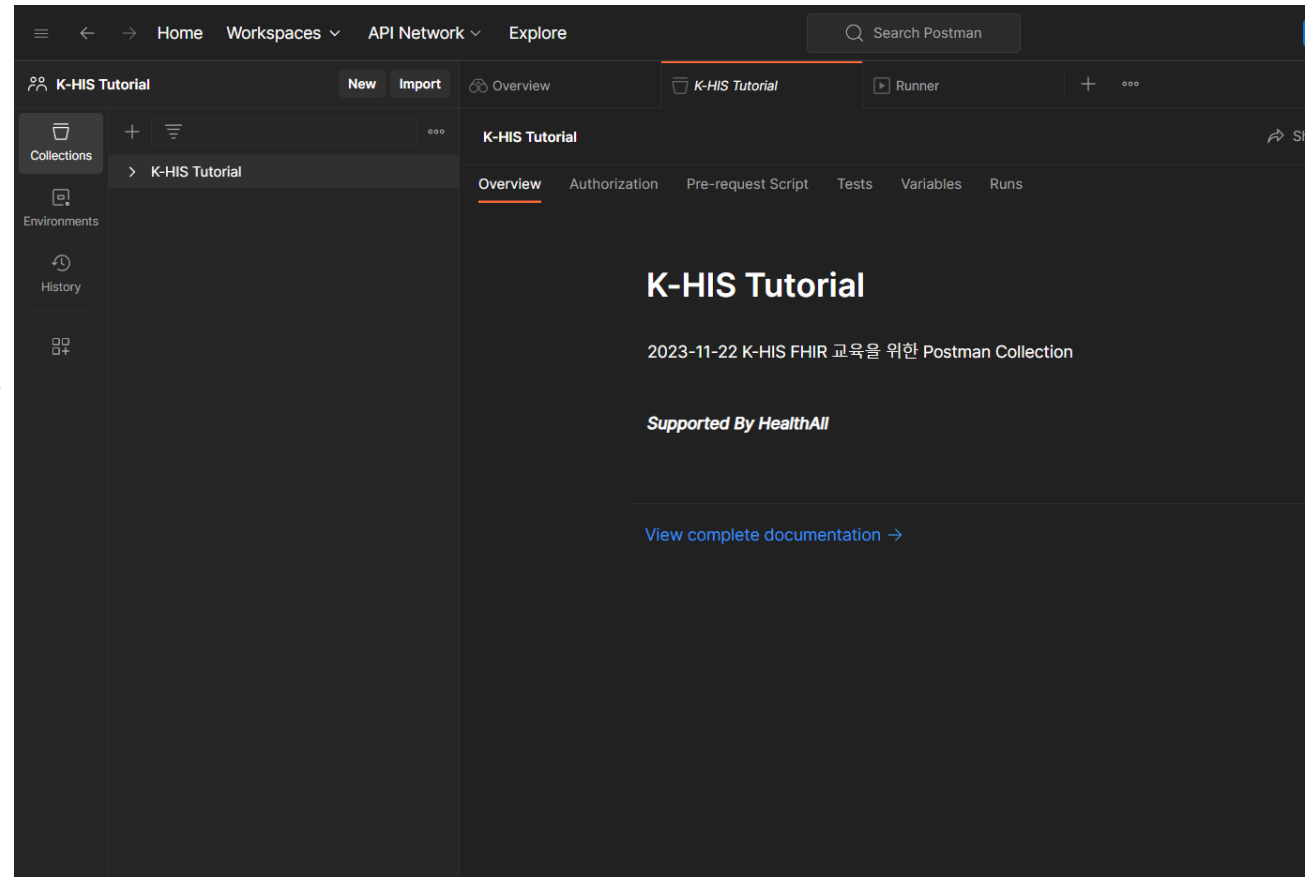
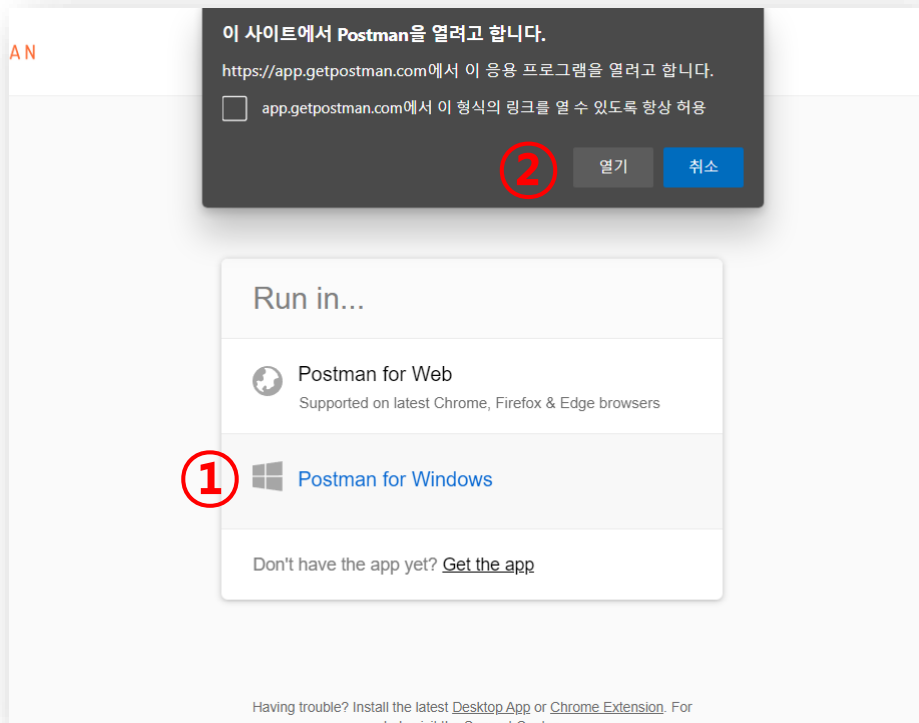
Date: Tue, 26 Sep 2023 04:41:53 GMT
X-Powered-By: HAPI FHIR 6.8.0 REST Server (FHIR Server: FHIR 4.0.1/R4)
Content-Type: application/fhir+xml; charset=utf-8
X-Request-ID: cwgAV7RtZVzrb8sG

Response Body

```
1  {
2    "resourceType": "CapabilityStatement",
3    "id": "d50112db-c6df-4319-a825-02103fbd43cf",
4    "name": "RestServer",
5    "status": "active",
6    "date": "2023-09-26T13:40:45.064+09:00",
7    "publisher": "Not provided",
8    "kind": "instance",
9    "software": {
10     "name": "HAPI FHIR Server",
11     "version": "6.8.0"
12   },
13   "implementation": {
14     "description": "HAPI FHIR R4 Server",
15     "url": "http://localhost:8080/fhir"
16   },
17   "fhirVersion": "4.0.1",
18   "format": [ "application/fhir+xml", "xml", "application/fhir+json", "json", "application/x-turtle", "ttl", "html/json", "html/xml", "html/turtle" ],
19   "patchFormat": [ "application/fhir+json", "application/fhir+xml", "application/json-patch+json", "application/xml-patch+xml" ],
20   "rest": [ {
21     "mode": "server",
22     "resource": [ {
23       "type": "Account",
24       "profile": "http://hl7.org/fhir/StructureDefinition/Account",
25       "interaction": [ {
26         "code": "search-type"
27       }, {
28         "code": "update"
29       }, {
30         "code": "vread"
31       }, {
32         "code": "read"
33       }, {
34         "code": "patch"
35       }, {
36         "code": "history-type"
37       }, {
38         "code": "history-instance"
39       }, {
40         "code": "delete"
41       }, {
```

KR Core Resource Example Link with Postman

- <https://app.getpostman.com/run-collection/22568473-8fc9837a-0c3c-4b24-bf10-bd0346ab0fc4?action=collection/import>



Create a Patient

- CRUDS
 - Create a Patient
- Response 메시지의 id 확인

The screenshot displays a REST client interface with a POST request to `http://localhost:8080/fhir/Patient`. The request body is a JSON object representing a patient resource. The response status is 201 Created, and the response body is a JSON object containing the created patient resource, with the `"id": "2"` field highlighted by a red box.

Request:

```
POST http://localhost:8080/fhir/Patient
{
  "resourceType": "Patient",
  "identifier": [
    {
      "type": {
        "coding": [
          {
            "system": "http://terminology.hl7.org/CodeSystem/v2-0203",
            "code": "MR"
          }
        ]
      }
    }
  ]
}
```

Response:

```
Status: 201 Created Time: 65 ms Size: 2.08 KB
{
  "resourceType": "Patient",
  "id": "2",
  "meta": {
    "versionId": "1",
    "lastUpdated": "2023-11-23T10:16:35.968+09:00",
    "source": "#4amPGpFxFHSItLoid"
  },
  "identifier": [
    {
      "type": {
        "coding": [

```

Read the Patient

- CRUDS
 - Read the Patient
- Request Url 값으로 `{{baseUrl}}/Patient/{{patient_id}}` 사용

The screenshot shows a REST client interface with a GET request to `http://localhost:8080/fhir/Patient/2`. The **Send** button is highlighted with a red box. The response is displayed in the **Body** tab, showing a JSON object for a patient resource.

Query Params

Key	Value	Description
Key	Value	Description

Body | Cookies | Headers (10) | Test Results

Status: 200 OK | Time: 25 ms | Size: 2.02 KB | Save as example

Pretty | Raw | Preview | Visualize | JSON |

```
1 {
2   "resourceType": "Patient",
3   "id": "2",
4   "meta": {
5     "versionId": "1",
6     "lastUpdated": "2023-11-23T10:16:35.968+09:00",
7     "source": "#4amPGpFxFHSItLoid"
8   },
9   "identifier": [
10    {
11      "type": {
12        "coding": [
13          {
14            "system": "http://terminology.hl7.org/CodeSystem/v2-0203",
15            "code": "MR"
16          }
17        ]
18      },
19      "system": "http://www.hangukhospital.co.kr/pid-example",
```

Search Patients

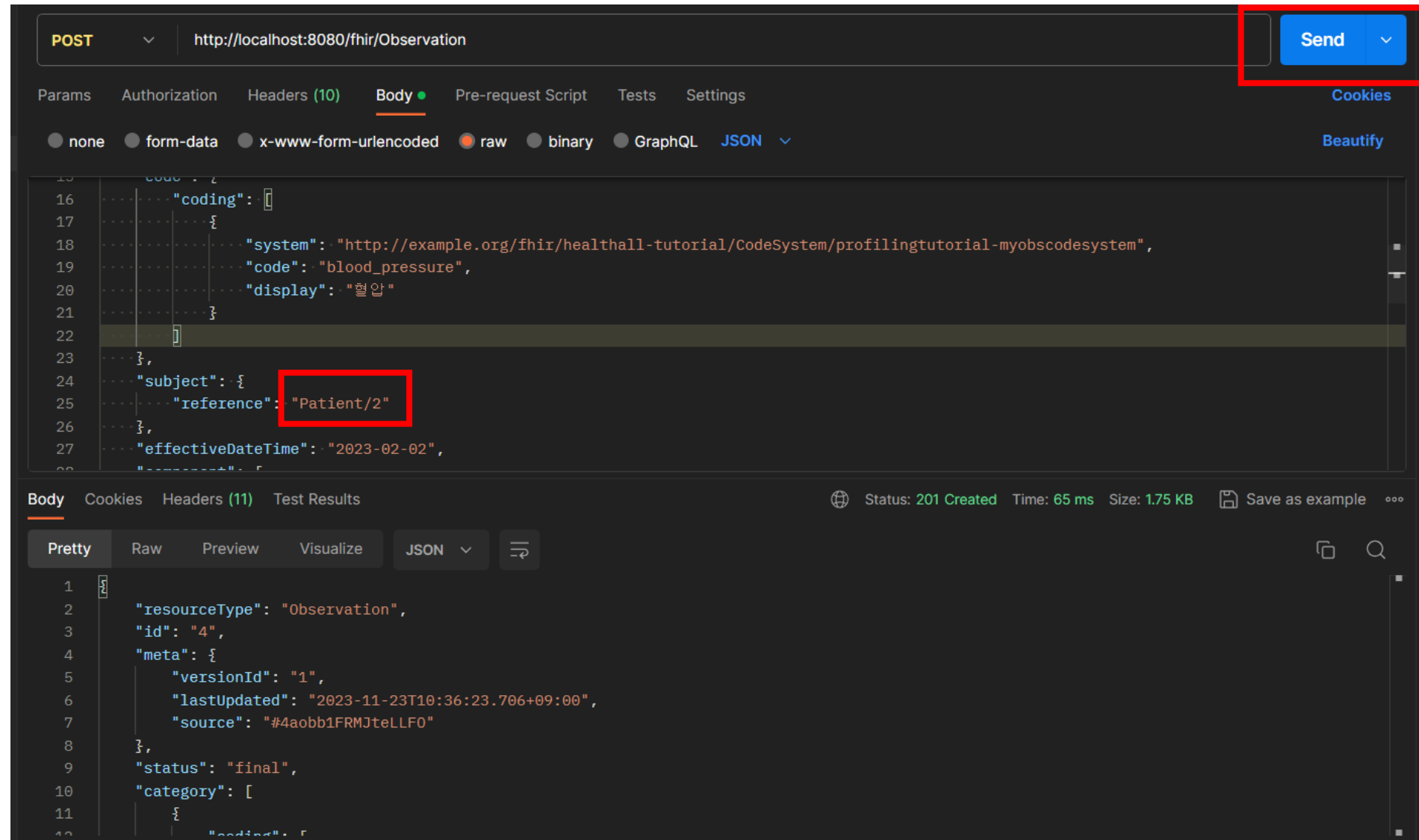
- 기본 Search Parameter는 각 리소스 설명 페이지에 정의되어 있음
 - <http://hl7.org/fhir/R4/patient.html#search>
 - <http://hl7.org/fhir/R4/observation.html#search>
- Search Parameter 유형에 따라 검색 방법이 다름
 - string
 - token
 - date
 - reference 등
 - <http://hl7.org/fhir/R4/search.html>

Create an Observation

- CRUDS

- Create an Observation

- Request 메시지의 subject.reference 값으로 Patient/{patient_id} 입력



Upload Conformance Resources

- 이전 실습을 통해 개발한 Tutorial IG의 Conformance Resource들을 Postman을 통해 HAPI FHIR JPA Server에 등록(Create)
- CodeSystem (MyObsCodeSystem)
- ValueSet (MyObsValueSet)
- StructureDefinition (MyPatient)
- StructureDefinition (MyObservation)

Resource Validation

- Tutorial IG의 Profile에 적합하지 않은 리소스 등록을 FHIR Server가 거부할 수 있는지 확인
 - Patient (Default)
 - Patient (MyPatient)(Error)
 - Patient (MyPatient)(Correct)
 - Observation (MyObservation)(Error)
 - Observation (MyObservation)(Correct)



감사합니다
