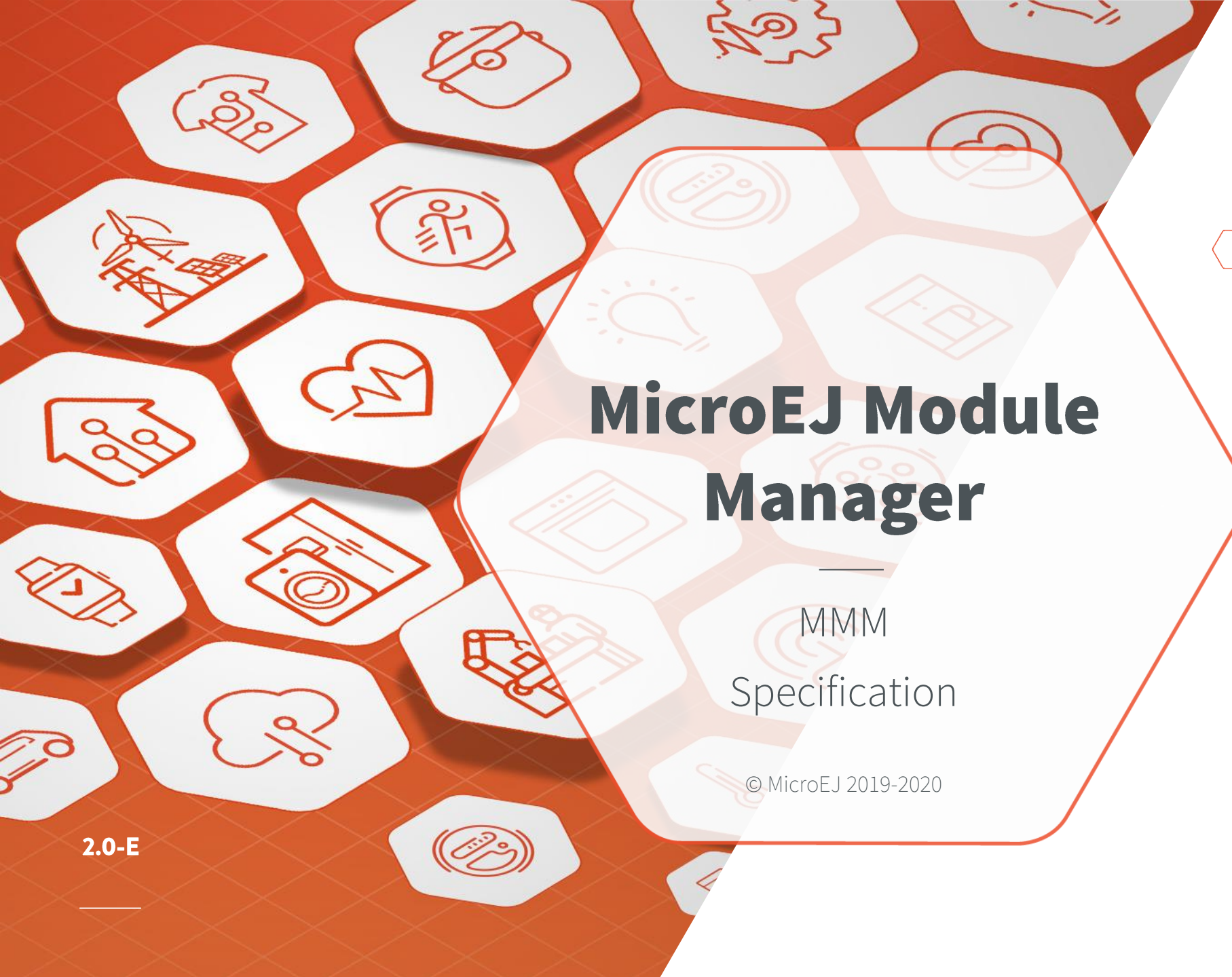


MicroEJ Module Manager

MMM

Specification

2.0-E

MICROEJ®

DISCLAIMER

MMM – MICROEJ MODULE MANAGER

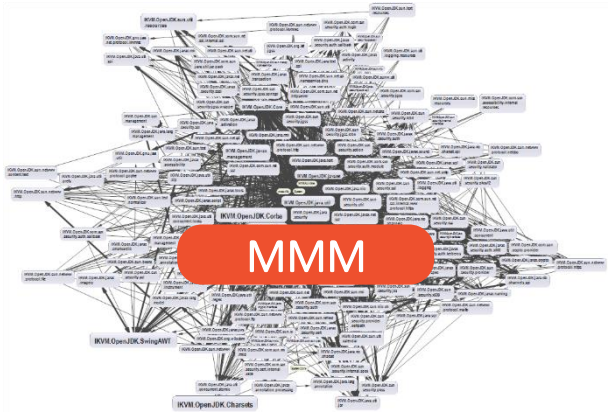
Modern electronic device design involves many parts and teams to collaborate to finally obtain a product to be sold on its market.

MicroEJ encourages modular design which involves various stake holders: hardware engineers, UX designers, graphic designers, drivers/BSP engineers, software engineers, etc.

Modular design is a design technique that emphasizes separating the functionality of an application into independent, interchangeable modules. Each module contains everything necessary to execute only one aspect of the desired functionality.

In order to have team members collaborate internally within their team and with other teams, MicroEJ SDK provides a powerful modular design concept, with smart module dependencies, controlled by the MMM.

The MMM frees engineers from the difficult task of computing module dependencies. Engineers specify the bare minimum description of the module requirements.

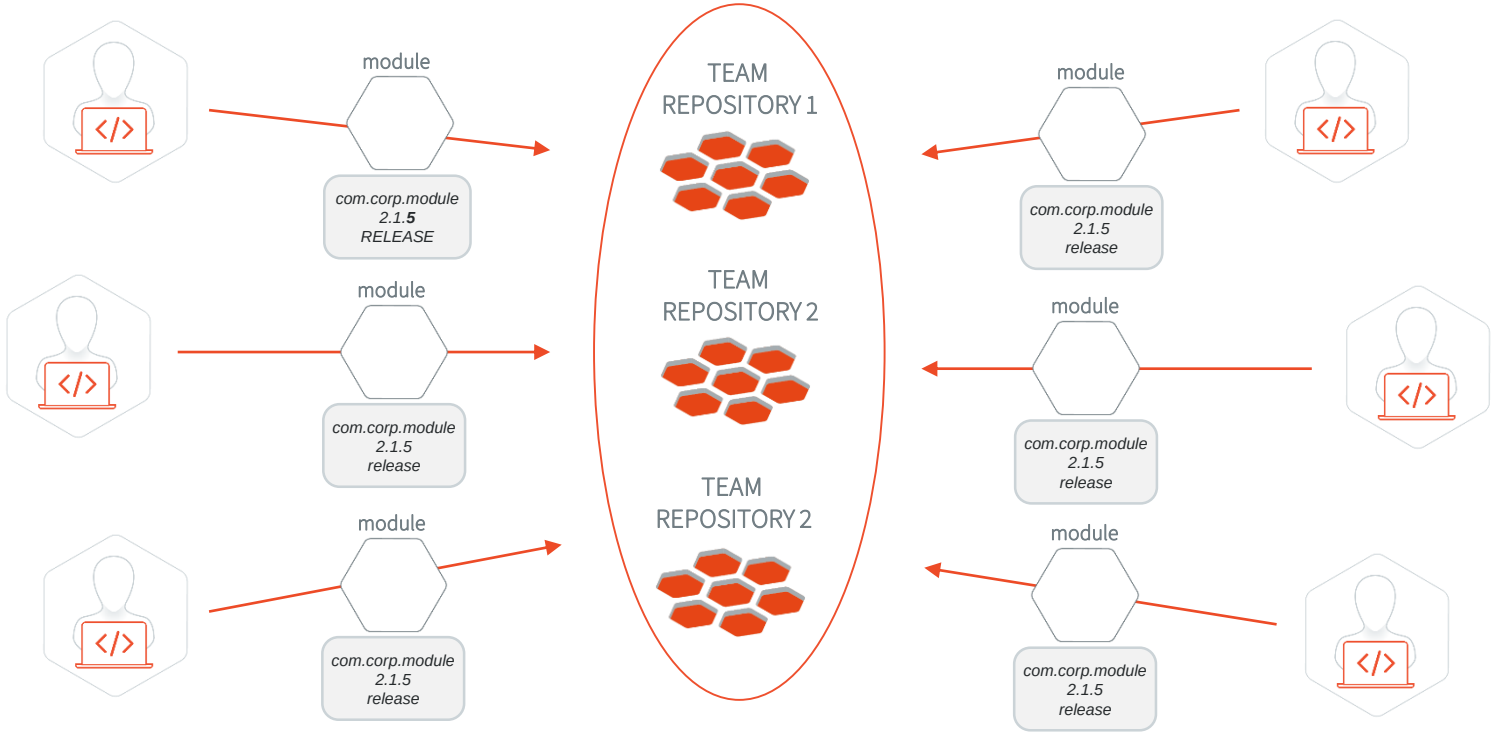


MODULE REPOSITORY

Modules are shared among developers using a “Repository “

A Repository can be :

- a filesystem organized using directories
- a database on a server
- a composite of multiple repositories



MODULE DEFINITION

A module is a set of files that contains some information (code, text files, binary files) to be stored in a repository and to be delivered to a work process when requested.

A module is uniquely identified by:

- An organization name (a sequence of dot-separated strings)
  - `[a-zA-Z0-9\-_]+ ( \. [a-zA-Z0-9\-_]+ )*`
- A name (a string with no dot)
  - `[a-zA-Z0-9\-_]+`
- A version (3 dot-separated numbers)
  - `M.m.p (\-RCYYYYMMDDHHmm)?`
  - `[0-9]+ \. [0-9]+ \. [0-9]+`

A module has the following information:

- A list of dependencies
- A build status: release vs snapshot
- A nature to qualify the content

MODULE LIFE CYCLE

Once delivered, the module is called a release

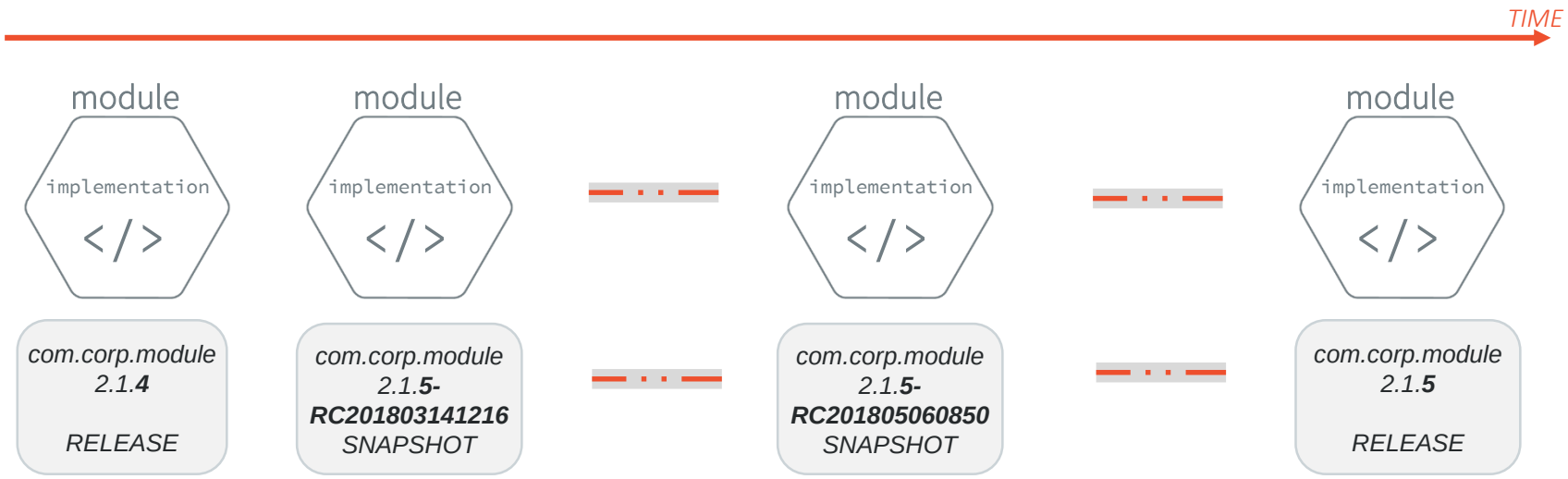
- It has a unique version with the only 3 numbers (`M.m.p`)
- A new module can only be delivered by incrementing its version

While not delivered, the module is called a snapshot

- Its version is suffixed with `–RCxxx` pattern
- A new module can be delivered by incrementing its `–RCxxx` version suffix

MMM follows Semantic Versioning v2 - https://semver.org/

- `M.m.p < M.m.p+1-RCxxx < M.m.p+1-RCxxx+1 < M.m.p+1`

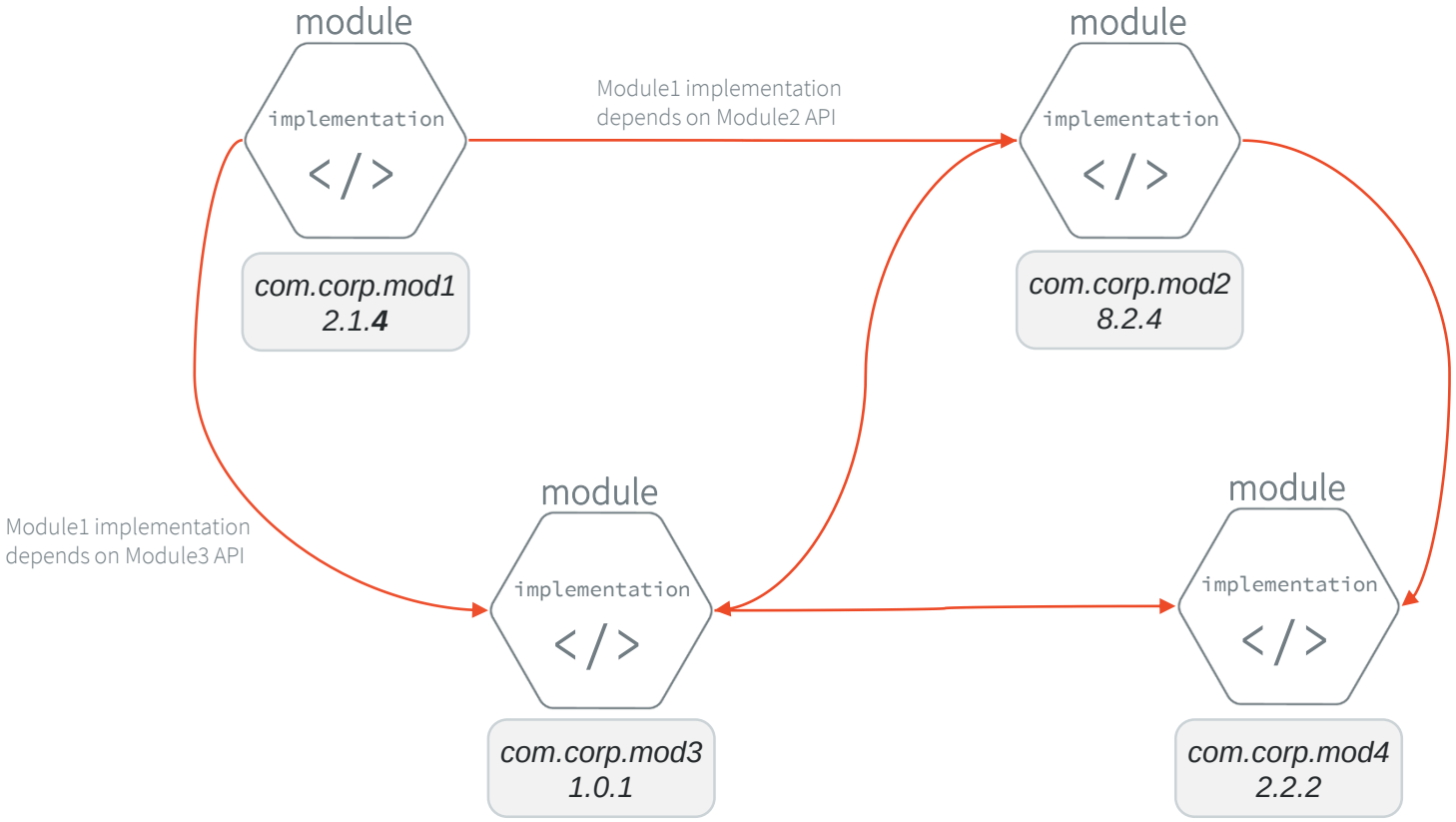


MODULE DEPENDENCIES (1/3)

A module dependency is a link from one module to another module

A module declares an ordered list of zero or more dependencies

The dependencies graph is a direct acyclic graph based on the module name and organisation but not module version number



MODULE DEPENDENCIES (2/3)

A dependency is described by

- An organization: same format as module organization
- A name: same format as module name
- A version: `major.minor.patch` (same format as module version)
- A matching rule: one of `compatible` (default), `equivalent`, `greaterOrEqual`, `perfect`
- A visibility: one of `public` (default) or `private`

MODULE DEPENDENCIES (3/3)

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Dependency Visibility

- A dependency declared `public` is transitively resolved by upper modules
- A dependency declared `private` is only used by the module itself, typically for:
  - Bundling the content into the module
  - Testing the module

Dependency Matching Rule

- The matching rule indicates the possibility for this module to be replaced by a higher version without breaking its specified behavior
- Matching rules are used for transitive dependencies resolution or for module update action
- The following table describes the available matching rules:

Name	Range Notation	Semantic
`compatible`	`[M.m.p-RC, (M+1).0.0-RC[`	Default if not set. Equal or up to next major version
`equivalent`	`[M.m.p-RC, M.(m+1).0-RC [`	Equal or up to next minor version
`greaterOrEqual`	`[M.m.p-RC, ∞[`	Equal or greater versions
`perfect`	`[M.m.p-RC, M.m.(p+1)-RC[`	Exact match (strong dependency)

MMM RESOLUTION SPECIFICATIONS

For each dependency,

- If the version is `M.m.p`, the fetched module is the **release** module, or the **most recent available snapshot** when there is not a released version yet.
- If the version is `M.m.p-RCYYYYMMDDHHmm`, the fetched module is this **exact** version
- if the dependency is `public` the resolved module dependencies are resolved recursively

If multiple versions of a module have been fetched,

- The final resolved version is the **highest** version, provided:
  - It matches the rule declared for each dependency
  - It is `equivalent` to the direct dependency declared version (if any)
- Otherwise, the resolution fails.

Modules are ordered using a depth-first search topological sort algorithm

- Use of the dependencies list order of each module.

MMM RESOLUTION EXAMPLES (1/4)

Dependency Graph	Repository Content	MMM Resolution (Ordered Result)
A |- B 1.0.0	B 1.0.0	B 1.0.0
A |- B 1.0.0	B 1.0.0 B 1.0.1	B 1.0.0
A |- B 1.0.0	B 1.0.0 B 1.1.0	B 1.0.0
A |- B 1.0.0	B 1.0.0-RC201805090841 B 1.0.0-RC201805091055 B 1.1.0	B 1.0.0-RC201805091055
A |- B 1.0.0	B 1.0.0-RC201805090841 B 1.0.0	B 1.0.0
A |- B 1.0.0 |- C 1.0.0	B 1.0.0 C 1.0.0	B 1.0.0 C 1.0.0
A |- B 1.0.0 |- C 1.0.0 |- C 1.1.0	B 1.0.0 C 1.0.0 C 1.1.0	B 1.0.0 C 1.1.0
A |- B 1.0.0 |- C 1.0.1 |- C 1.0.0	B 1.0.0 C 1.0.0 C 1.0.1	B 1.0.0 C 1.0.1
A |- B 1.0.0 |- C 1.0.0 |- D 1.0.0 |- C 1.1.0	B 1.0.0 C 1.0.0 C 1.1.0 D 1.0.0	B 1.0.0 D 1.0.0 C 1.1.0

Matching Rules

- Compatible (Default)
- E = Equivalent
- G = GreaterOrEqual
- P = Perfect

MMM RESOLUTION EXAMPLES (2/4)

Dependency Graph	Repository Content	MMM Resolution (Ordered Result)
A |- B 1.0.0 (P)	B 1.0.0 B 1.0.1	B 1.0.0
A |- B 1.0.0 (E)	B 1.0.0 B 1.1.0	B 1.0.0
A |- B 1.0.0 (G)	B 1.0.0 B 2.0.0	B 1.0.0
A |- B 1.0.0 |- C 1.0.0 (G) |- C 2.0.0	B 1.0.0 C 1.0.0 C 2.0.0	B 1.0.0 C 2.0.0
A |- B 1.0.0 |- C 1.0.0 (G) |- D 1.0.0 |- C 2.0.0	B 1.0.0 C 1.0.0 C 2.0.0 D 1.0.0	B 1.0.0 D 1.0.0 C 2.0.0

Matching Rules

- Compatible (Default)
- E = Equivalent
- G = GreaterOrEqual
- P = Perfect

MMM RESOLUTION EXAMPLES (3/4)

Dependency Graph	Repository Content	MMM Resolution (Ordered Result)
A |- B 1.0.0	ø	ERROR B 1.0.0 not found
A |- B 1.0.0 |- C 1.0.0	B 1.0.0 C 1.1.0	ERROR C 1.0.0 not found
A |- B 1.0.0	B 1.0.1	ERROR B 1.0.0 not found
A |- B 1.0.0	B 1.1.0	ERROR B 1.0.0 not found
A |- B 1.0.0 |- C 1.1.0 |- C 1.0.0	B 1.0.0 C 1.1.0	ERROR C 1.0.0 not found
A |- B 1.0.0 |- C 1.1.0 |- C 1.0.0	B 1.0.0 C 1.0.0 C 1.1.0	ERROR The higher version required by B->C is not equivalent to the version declared by A->C as a direct dependency)
A |- B 1.0.0 |- C 1.0.0 |- C 2.0.0	B 1.0.0 C 1.0.0 C 2.0.0	ERROR The higher version required by B->C is not equivalent to the version declared by A->C as a direct dependency)

Matching Rules

- Compatible (Default)
- E = Equivalent
- G = GreaterOrEqual
- P = Perfect

MMM RESOLUTION EXAMPLES (4/4)

Dependency Graph	Repository Content	MMM Resolution (Ordered Result)
A |- B 1.0.0 |- C 1.0.0 |- D 1.0.0 |- C 2.0.0	B 1.0.0 C 1.0.0 C 2.0.0 D 1.0.0	ERROR The higher version required by D->C is not compatible to the version declared by B->C)
A |- B 1.0.0 |- C 1.0.0 (P) |- D 1.0.0 |- C 1.0.1	B 1.0.0 C 1.0.0 C 1.0.1	ERROR The higher version required by D->C is not perfect to the version declared by B->C)
A |- B 1.0.0 |- C 1.0.0 (E) |- D 1.0.0 |- C 1.1.0	B 1.0.0 C 1.0.0 C 1.1.0	ERROR The higher version required by D->C is not equivalent to the version declared by B->C)

Matching Rules

- Compatible (Default)
- E = Equivalent
- G = GreaterOrEqual
- P = Perfect

UPDATE ACTION

The module dependencies list is modified as following:

- For each dependency, search in the repository for the latest available version still valid for the matching rule and update to this version
- (Dependencies marked with matching rule `perfect` are never updated)

UPDATE can be applied

- Manually, from the IDE or command line (ANT Task)
- Automatically, before resolution, each time a module is built

UPDATE ACTION EXAMPLES

Dependency Graph (Before)	Repository Content	Dependency Graph (After)
A |- B 1.0.0	B 1.0.0	A |- B 1.0.0
A |- B 1.0.0	B 1.0.0 B 1.1.0	A |- B 1.1.0
A |- B 1.0.0	B 1.0.0 B 1.1.0 B 2.0.0	A |- B 1.1.0
A |- B 1.0.0	B 1.0.0 B 1.1.0- RC201805090841	A |- B 1.1.0
A |- B 1.0.0 (G)	B 1.0.0 B 1.1.0 B 2.0.0	A |- B 2.0.0
A |- B 1.0.0 (E)	B 1.0.0 B 1.0.1 B 1.1.0 B 2.0.0	A |- B 1.0.1
A |- B 1.0.0 (P)	B 1.0.0 B 1.0.1 B 1.1.0 B 2.0.0	A |- B 1.0.0

MMM IVY / EASYANT MAPPING

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Enable MicroEJ MMM specification

- Add `ej:version` on Ivy module header
  - `<ivy-module version="2.0" xmlns:ej="https://developer.microej.com" ej:version="2.0.0">`

Specify a dependency matching rule

- Add `ej:match` on dependency line
  - `<dependency org="xxx" name="xxx" rev="3.0.0" ej:match="perfect"/>`

Enable Automatic Update before resolution

- Add the following Easyant plugin dependency
  - `<ea:plugin org="com.is2t.easyant.plugins" module="ivy-update" revision="1.+"/>`

Declare a `private` dependency

- Declare a private configuration
  - `<conf name="[conf_name]" visibility="private">`
- Add the configuration mapping on dependency line
  - `<dependency … conf="[conf_name]->*">`

COMPATIBILITY MODE

MMM is compatible with any legacy built MicroEJ modules.

- When a legacy module is resolved from a MMM module, each of its dependencies are automatically converted as following:
  - The version is the version that was used when the module was built (Ivy `rev` field)
  - The matching rule is based on the declared revision range (Ivy `revConstraint` field), with the following conversions:

Legacy Module **`revConstraint`**	MMM Matching Rule
`[M.m.p, M+1.u.v[`	`compatible`
`[M.m.p, M.m+1.u[`	`equivalent`
`[M.m.p, M.m.p+1[`	`perfect`
`[M.m.p,)`	`greaterOrEqual`
`+`	`greaterOrEqual`
`M.+`	`compatible`
`M.m.+`	`equivalent`
Any other unrecognized pattern	`compatible`

INTERNAL UNDERSTANDING NOTES

Whatever the target repository content, release dependencies are always resolved with the same versions (snapshots are automatically updated to the most recent version)

Uploading modules to a server does not change resolution result (for release modules), but update action result

Matching Rules specification is Eclipse Feature matching rule

- https://help.eclipse.org/photon/index.jsp?topic=%2Forg.eclipse.platform.doc.isv%2Freference%2Fmisc%2Ffeature_manifest.html

WHY?

Simplify usage

Deterministic result

- Ivy ranges notation was used for 3 different reasons:
  - Allow to fetch snasphots modules while it is not yet released
  - Allow the fetch of multiple versions before conflict resolution (otherwise `latest-compatible` resolution triggers an error)
  - Get the latest available version in the repository

Semantic designed for

- cache only resolution (offline)
- repositories connection with high request latency (VPN: ~60ms per request)

Extract semantic out of tools

- Prepare a GUI view
- Prepare to use other dependency managers than Ivy in the future (or other IDEs)
- Documentation

CHANGELOG

2.0-E - 2020-11-18

- Fixes wrong displayed characters
- Fixed `greaterOrEqual` instead of `greater` in compatibility mode
- Clarified that default matching rule is `compatible` in MMM resolution examples
- Added Ivy mapping to declare a private dependency

2.0-D - 2020-04-02

- Updated the MicroEJ presentation template and schematics

2.0-C - 2019-06-27

- Fixed regular expression (escaped '. ' and '-' reserved characters)

2.0-B - 2019-03-15

- Added a Changelog
- Fixed missing '-' character in organization string pattern

2.0-A - 2018-10-02

- Initial Revision

THANK YOU

for your attention !

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