HOW TO BETTER BREAK SOFTWARE

FIXING SEMANTIC VERSIONING

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ABSTRACT

- Semantic Versioning is the current standard for supporting software changes over time
- It also an integral part of the OSGi platform
- Over the years it has become apparent that although Semantic Versioning allows us to express breaking changes, it does not do a good job in supporting the actual transition from the old to the new
- The Semantic Versioning of today favors the parties that are slow to adopt the change, making life hard for everyone else
- We will demonstrate in a straightforward way what happens when we break software and discuss a surprisingly simple approach to fix Semantic Versioning so that it allows all parties (fast and slow) to proceed at their own pace.

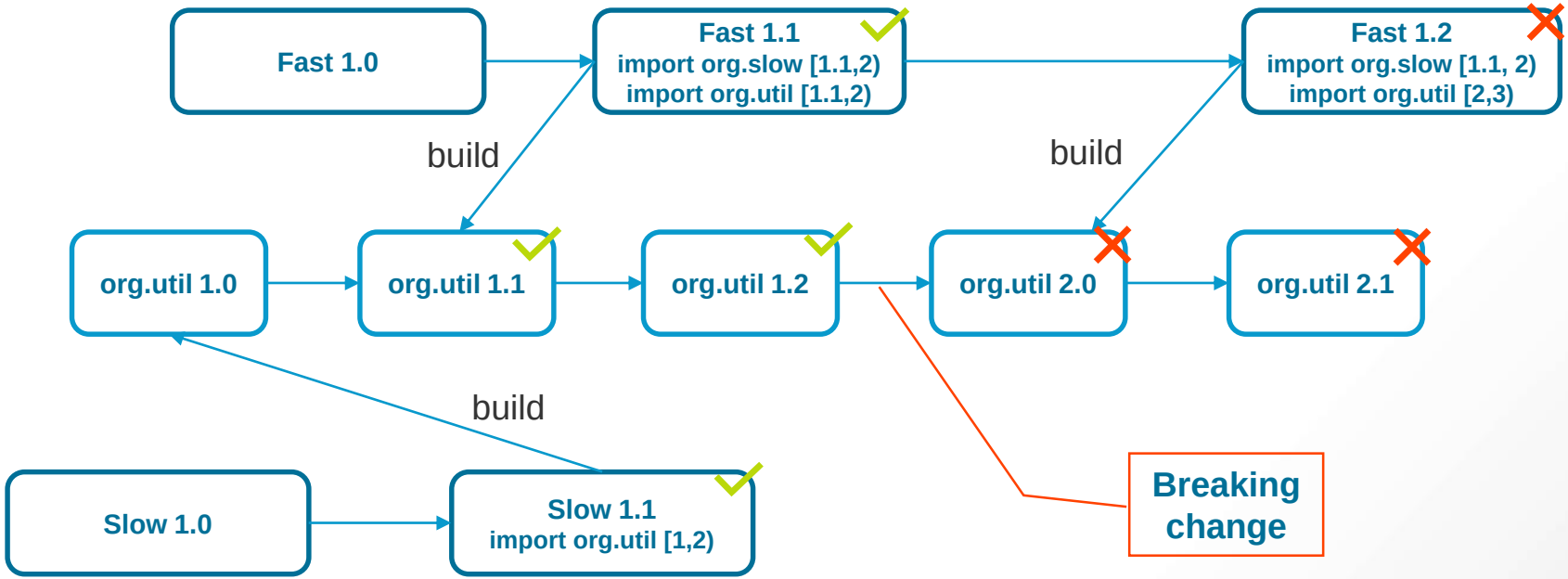
OVERVIEW

- Motivation
- Example
- Proposed convention
- Reasoning
- Revised example
- Findings
- Open ends

MOTIVATION

- We have found ourselves unable to introduce breaking changes even when using Semantic Versioning
- Consider org.osgi.framework;version=2.0
  - E.g. to get rid of Dictionary in APIs
- No good way to move consumers to new universe
- In fact, we have never introduced a breaking change in 20 years
  - Except DMT API, where we introduced a new package, starting at version 2
- JDK has also never broken a package
  - E.g. java.nio as successor to java.io
- E.g. log4j 2 as successor to log4j 1.x

EXAMPLE: CODE EVOLUTION



EXPECTATIONS

- Humans expect that semantic versioning alone solves all issues with software evolution
- How humans expect things to work
  - Introduce relative time by adding *semantic versions* to the names that languages use
  - Change introduced by *accretion*, not *replacement*
  - All built artifacts are there *for all time* for any consumer to bind to
  - Then the modular system can select one version of a name that is compatible with all deployed consumers
  - The module system can force everyone to eventually migrate so I work only against clean code
- How human expectations fail
  - Because *accretion is in fact violated w*hen a breaking change is introduced

BREAKING CHANGE (DEFINITION)

- The meaning of the name changes beyond the understanding of the current consumers. This is why it is called "breaking”
- Q: Why can’t the modular system reliably support a breaking change, even with semantic versioning?
- A: Principle of accretion is violated
  - Breaking change *replaces* the old meaning with a new meaning
  - Code binds to names from other pieces of code that evolve independently
  - Language can't cope: one compilation unit may have to be exposed to both meanings at the same time
  - This goes against the fundamentals of the language
  - No versions in the names/identifiers; no “import org.util.foo@2.0.0 as foo2”
- Modular systems are responsible for composing a consistent namespace
  - OSGi helps via “uses” constraints and class space isolation, but can not fix the fundamental issue (cannot break Java)

BREAKING CHANGE (SOLUTION)

- Accretion: Breaking change introduces a new name
- It is no longer “breaking”
- If there is need for a compilation unit to use both versions the language/compiler will *force them to*

PROPOSED CONVENTION

1. `org.example.foo; version=0.0.1`
   - The prototype period when the contract is first being defined
   - Package name is reserved
   - Breakage is allowed now and only now
2. `org.example.foo; version=1.0.0`
   - The contract and the package name become locked down
3. `org.example.foo; version=1.0.1`
   - The contract is not changed
4. `org.example.foo; version=1.1.0`
   - The contract is enriched, but not invalidated
5. *`org.example.foo; version=2.0.0`*
   - *ILLEGAL: The original contract is destroyed and replaced by something else*
   - *The relation between old and new becomes too abstract for the machines to cope: language, tools, etc.*
6. `org.example.foo.v2; version=2.0.0`
   - New contract bound to the new package
   - The bundle name and version reflect continuity

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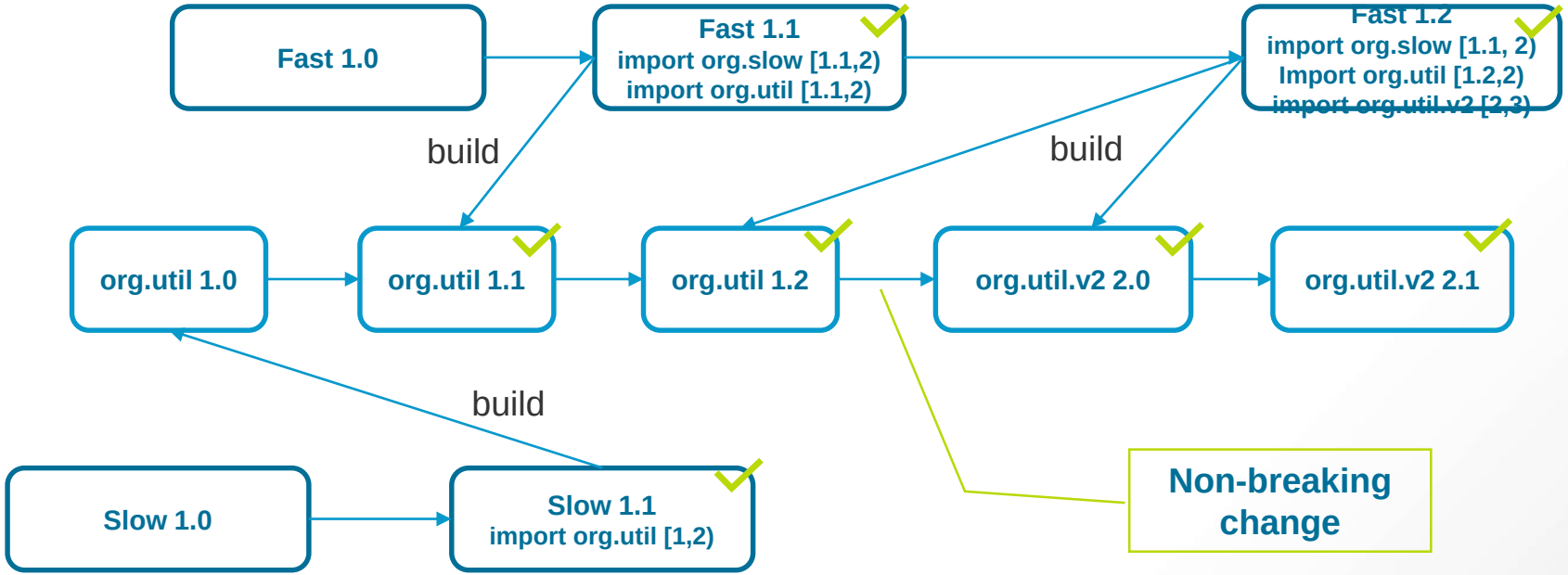

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FINDINGS (PRO)

- Practical migration to new version is possible
- Migration can in some cases be postponed forever
- Adapters can be used to re-implement old on new
  - One compilation unit built against both versions
  - Maintaining the adapter may be cheaper than maintaining the old version
- Maintainer of an API can release an adapter with the change
  - Stateful code needs adapters
  - Only one instance of the state can exist for both versions
  - E.g. Declarative Services and Configuration Admin are effectively singletons
- This addresses “uses” constraint violations
  - Where two incompatible contracts are consumed by one module

FINDINGS (CON)

- Looks odd to some people
- In the case of OSGi introduces additional complexity to the already complex versioning model
  - Closed version ranges still should be used by both consumers (‘[1.1, 2)’) and providers (‘[1.1, 1.2)’)
  - However the upper boundary in the consumer case is never violated
- Harder to track abstract continuity
  - Machines can no longer see the evolution into the new name, unless they themselves enforce the ‘org.example.foo.v2’ convention
  - Humans can choose bad new names that make it hard for other humans to understand the continuity

NEXT

OSGi endorses the idea

So evangelize it and make it palatable

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FEEDBACK