Buildroot Eclipse Bundle : A powerful IDE for Embedded Linux developers

www.flickr.com/photos/playdogil/3408511286/

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Obeo

EclipseCON
BOSTON 2013

Who Am I ?

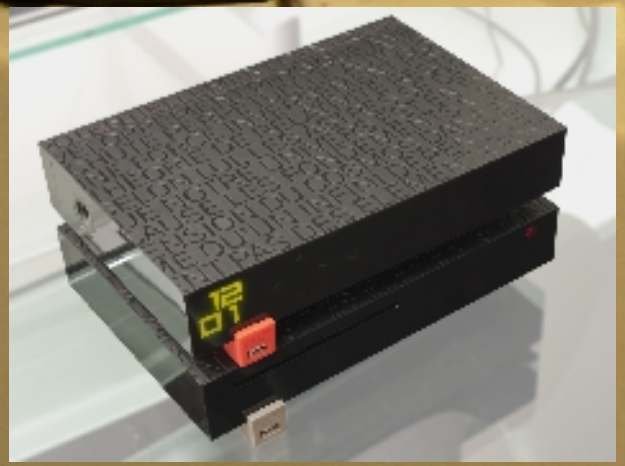
http://www.flickr.com/photos/anotherashia/5319361416

What is embedded Linux ?

Specific applications

Open source components

Linux kernel



Building an embedded Linux system

Binary distributions

- Heavyweight systems
- Not all CPU architectures supported
- Not flexible to choose the configuration for each components

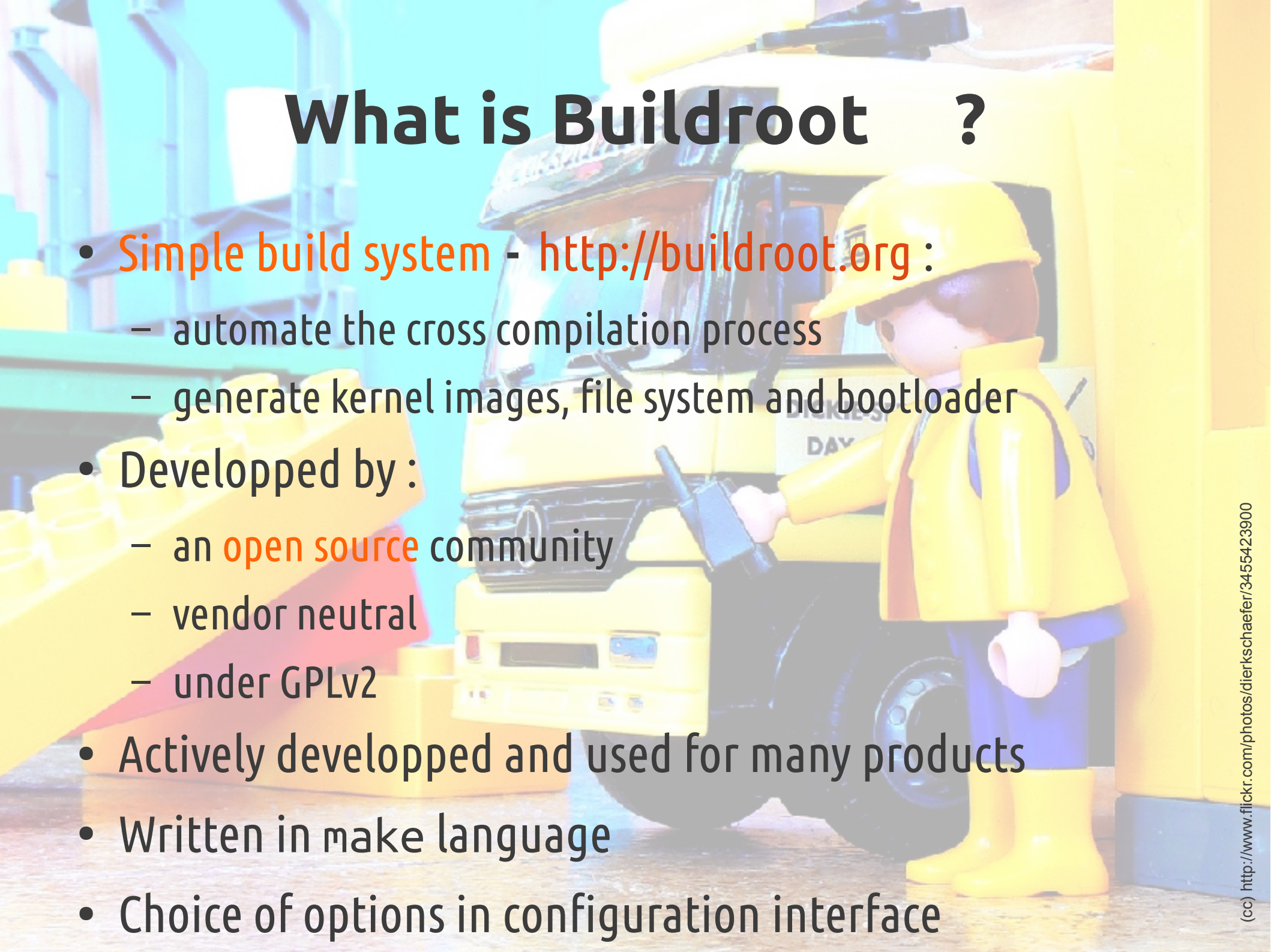
Building tools

OpenWRT PTXdist

- Automate system reconstruction from source code
- Support many more CPU architectures
- High flexibility on components configuration
- Most used solution

What is Buildroot ?

- Simple build system - http://buildroot.org :
  - automate the cross compilation process
  - generate kernel images, file system and bootloader
- Developped by :
  - an open source community
  - vendor neutral
  - under GPLv2
- Actively developped and used for many products
- Written in make language
- Choice of options in configuration interface



Demo hardware platform

- Fairly typical ARM evaluation platform
- Many devices: Screen, Network, SD card, USB ...
- Used to develop prototypes
- Reference to design specific board

Atmel AT91SAM9G45 (ARMv5) processor

Buildroot Demo

m/photos/dierkschaefer/3454606933

Buildroot generates

Inputs

Openssh source

BusyBox source

DirectFB source

Specific Library source

Kernel source

Pre compiled Toolchain

gcc

binutils

gdb

Libc

Buildroot

Outputs

Target (ARM)

Target File System

Libc

Openssh

BusyBox

Specific Library

DirectFB

Applications

Kernel Image

Host (PC)

Toolchain

Openssh headers & lib

DirectFB headers & lib

Specific lib headers & lib

gcc

binutils

gdb

Libc

Various host utilities : Pkg-config...

Why Integrating Buildroot in Eclipse ?

System developers

Application developers

http://www.flickr.com/photos/sontranphotos/6305201837

Why Integrating Buildroot in Eclipse ?

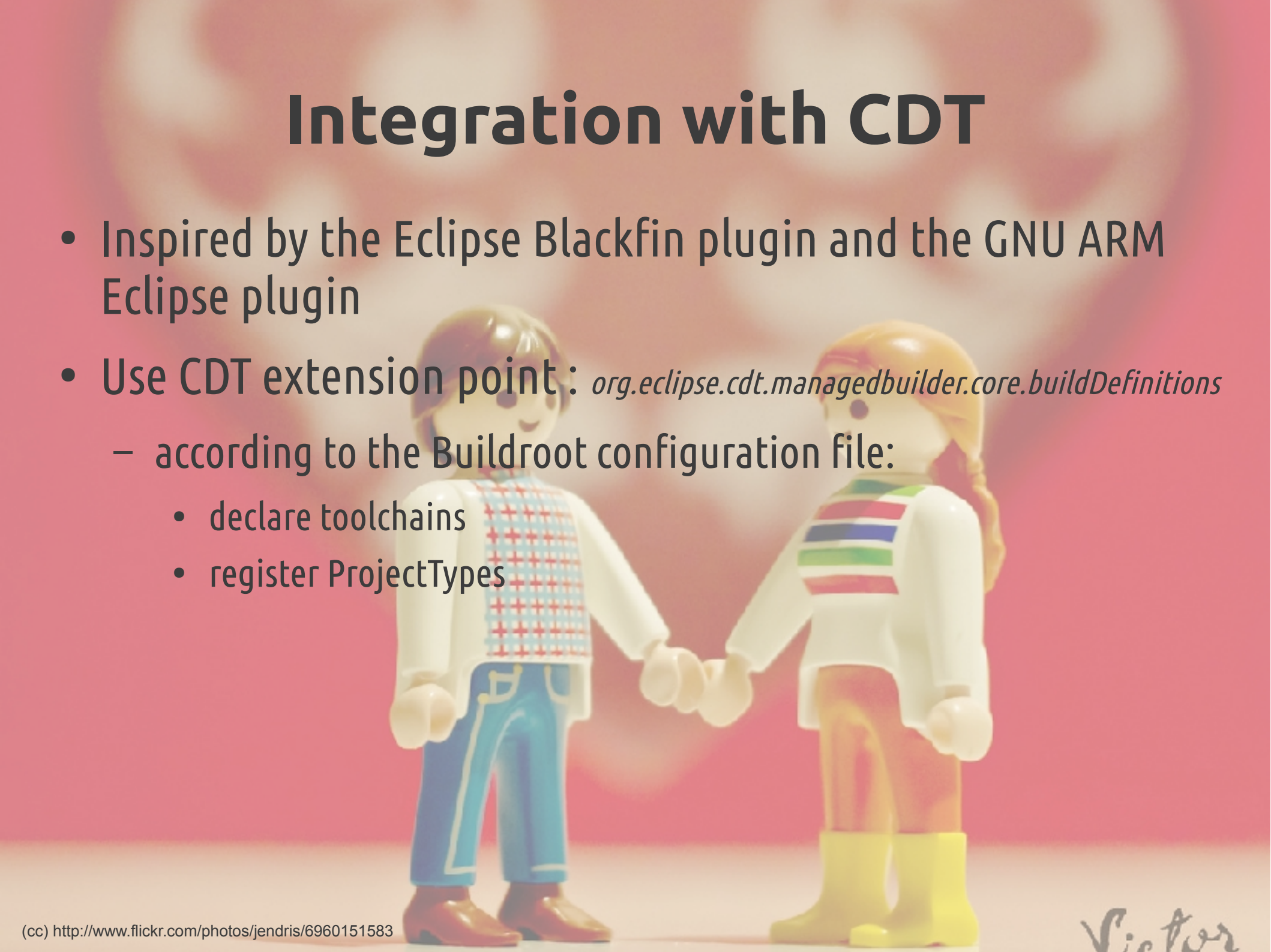
- Open source IDE for Application developers
  - Preconfigured with the cross compilation toolchain
  - Easy access to the libraries available on the target
  - Transfer / Execute remote application
  - Remote Debug

Buildroot toolchain Eclipse plugin

- Integrate the toolchains to Eclipse CDT
  - Read the toolchain description file (/home/<user>/.buildroot-eclipse.toolchains)
  - Register dynamically the toolchains in CDT for :
    - Managed build projects : executable, static library, shared library
    - Autotools projects
    - Makefile projects

Integration with CDT

- Inspired by the Eclipse Blackfin plugin and the GNU ARM Eclipse plugin
- Use CDT extension point : *org.eclipse.cdt.managedbuilder.core.buildDefinitions*
  - according to the Buildroot configuration file:
    - declare toolchains
    - register ProjectTypes



Managed build Integration

- Add the Buildroot toolchains available for:
  - Executable project
  - Static library project
  - Shared library project
- Contribute to `plugin.xml` :

```
<projectType
buildArtefactType="org.eclipse.cdt.build.core.buil
dArtefactType.exe" ...>
```

Buildroot Launch configurations

- Provide Remote configurations :
  - Launch configuration : execute the application on target
  - Remote Debug configuration : which point automatically on the correct cross-debugger

Buildroot Eclipse plugin demonstration

Pkg-config ?

- Applications need other libraries than just the standard C/C++ library
  - Graphical, network, crypto libraries …
- Manually adding compiler and linker flags is annoying
- Pkg-config is a standard Linux tool to query the compiler and linker flags for a given library

```
$ pkg-config --cflags directfb
-D_REENTRANT -I<...>/sysroot/usr/include/directfb

$ pkg-config --libs directfb
-ldirectfb -lfusion -ldirect -lpthread
```

Managed build Integration : pkg-config plugin

- Contribute to existing pkg-config plugin :

  http://code.google.com/p/pkg-config-support-for-eclipse-cdt/

  - Fix bugs on PKG_CONFIG_PATH and pkg-config binary path
  - Use the pkg-config environment variables directly on command
  - Move the pkg-config configuration to project-level
  - Improve the UI
  - Allow a per-toolchain specified pkg-config binary

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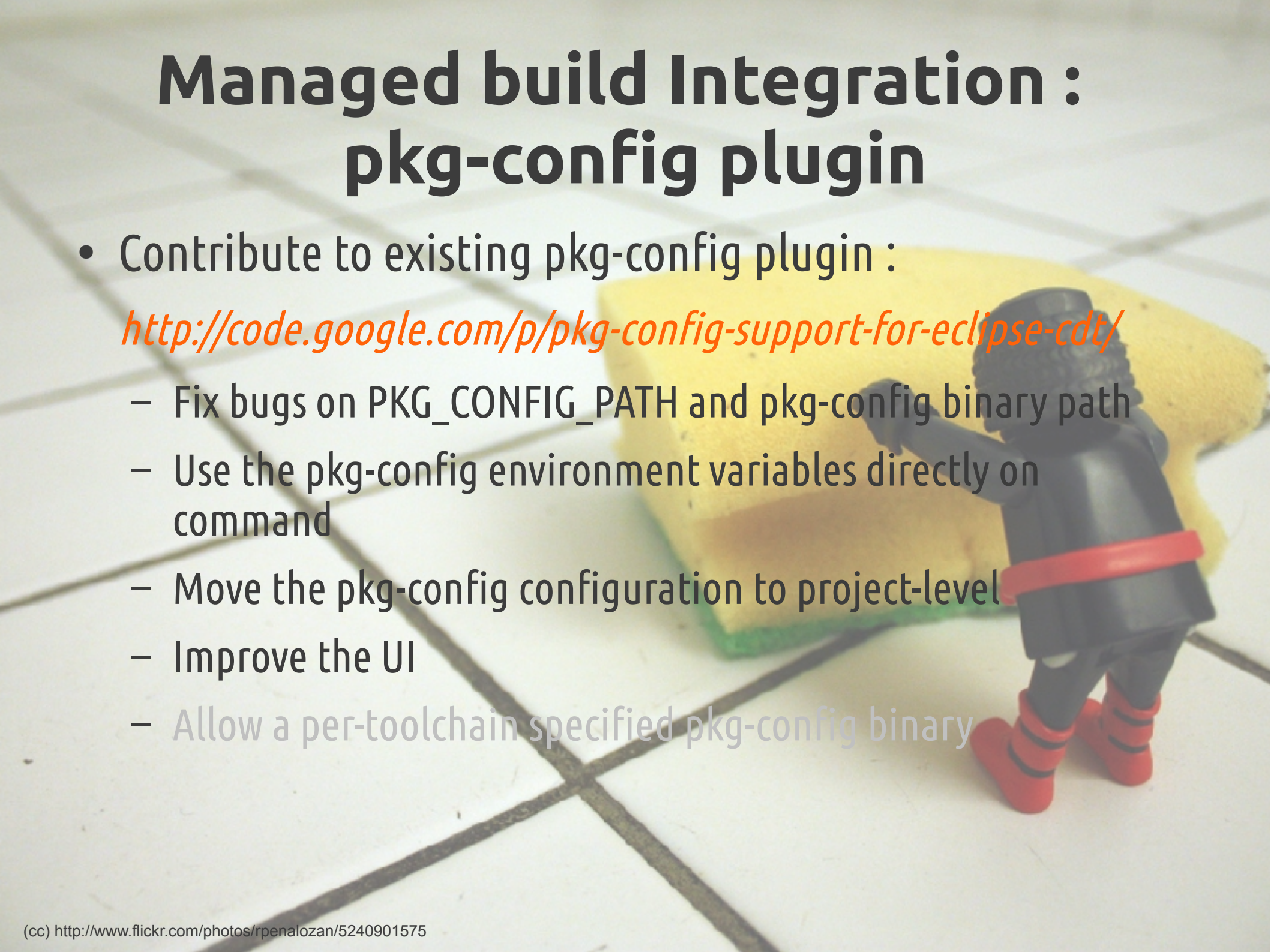

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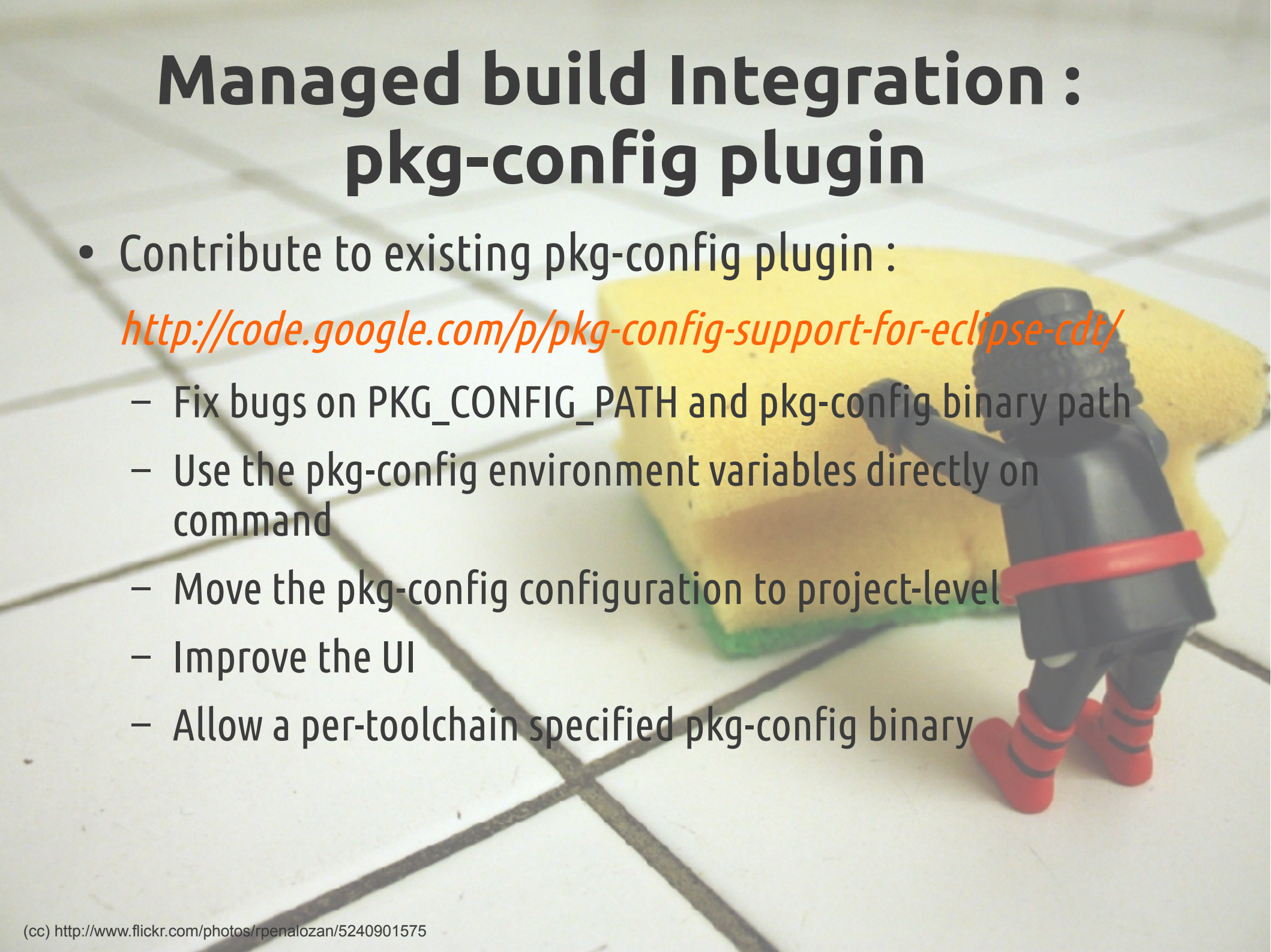


Buildroot pkg-config plugin demonstration

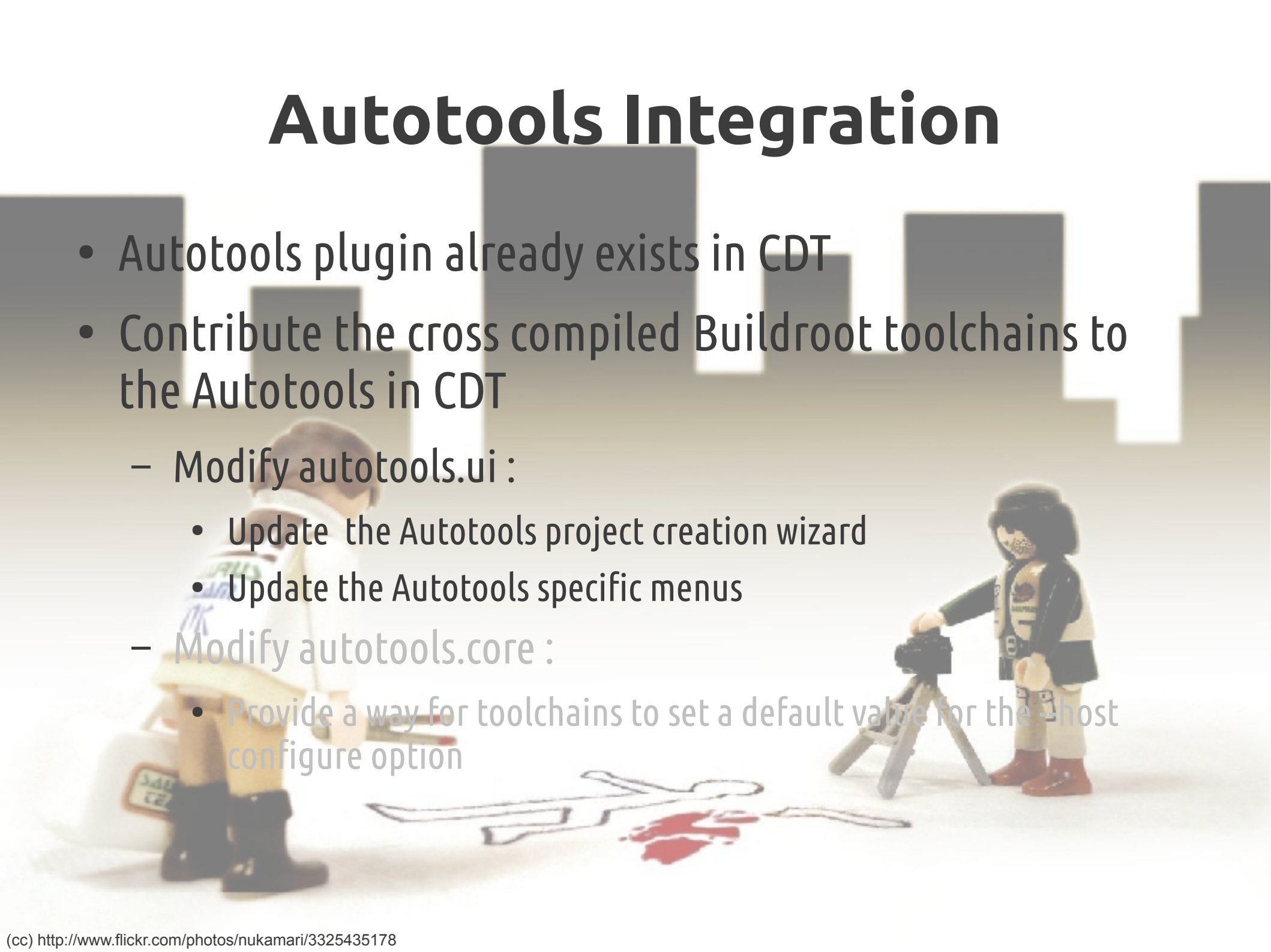
ww.flickr.com/photos/rpenalozan/5821522384

Autotools ?

- The most common configuration and build system for Linux software components
- Composed of autoconf, automake and libtool
- Developers write :
  - Configure.ac
  - Makefile.am
- Final makefiles generated by those tools

Autotools Integration

- Autotools plugin already exists in CDT
- Contribute the cross compiled Buildroot toolchains to the Autotools in CDT
  - Modify autotools.ui :
    - Update the Autotools project creation wizard
    - Update the Autotools specific menus
  - Modify autotools.core :
    - Provide a way for toolchains to set a default value for the --host configure option



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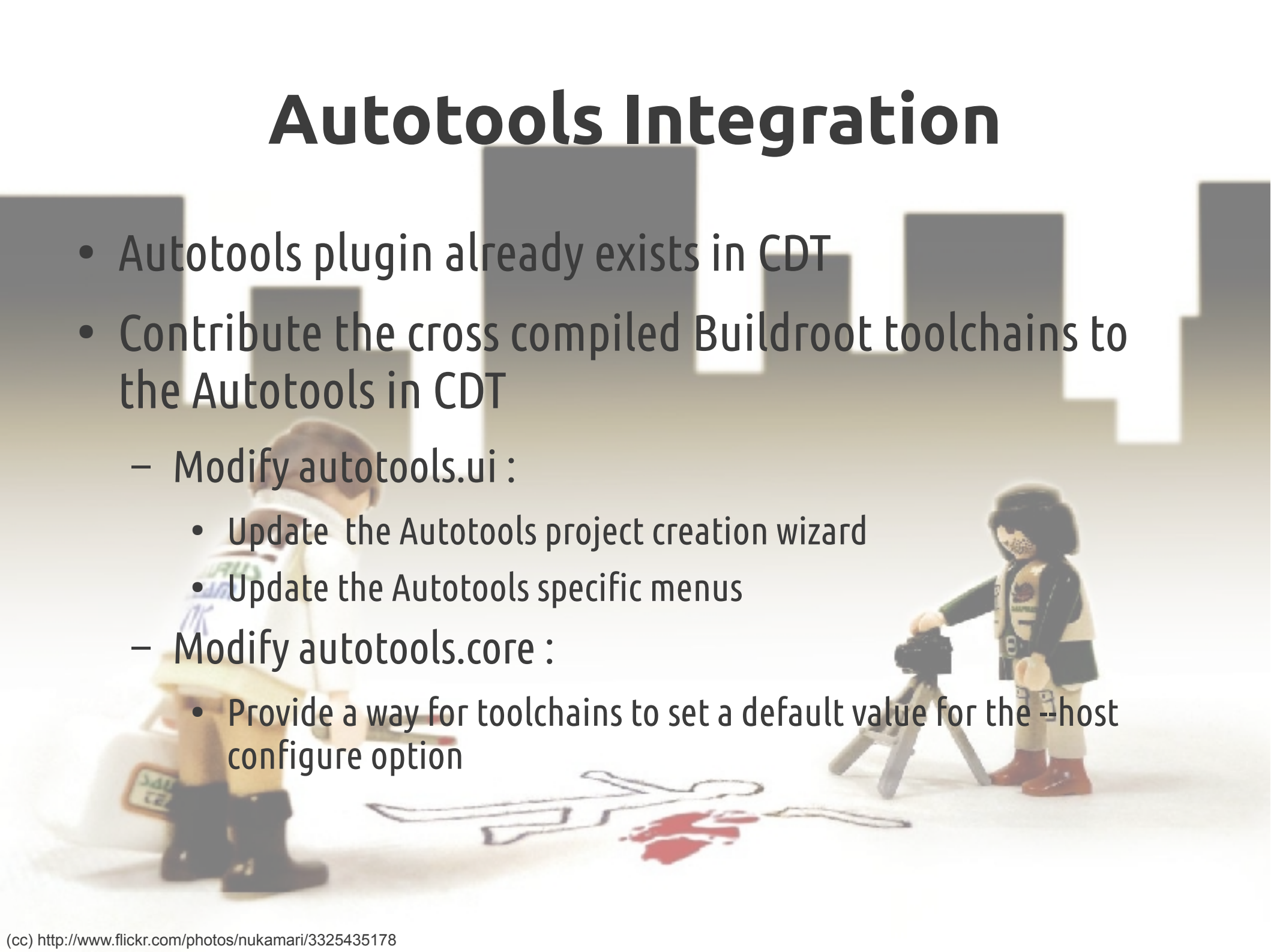


Buildroot Autotools integration demonstration

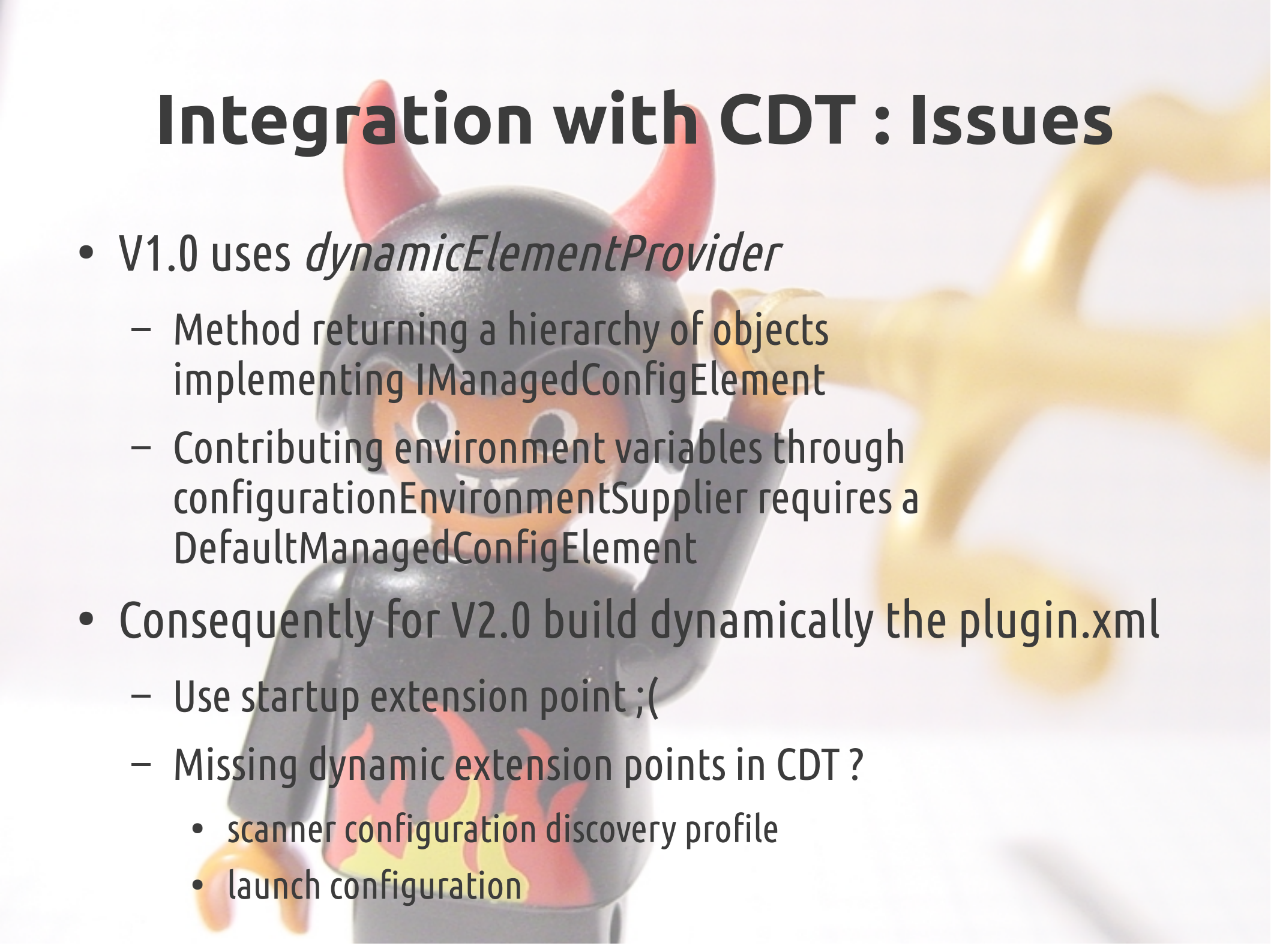
Integration with Makefile

- Add Buildroot toolchain to Makefile projects
  - Add some environment variables :
    - PATH
    - CC
    - CXX

    Those are typically used in standard makefiles

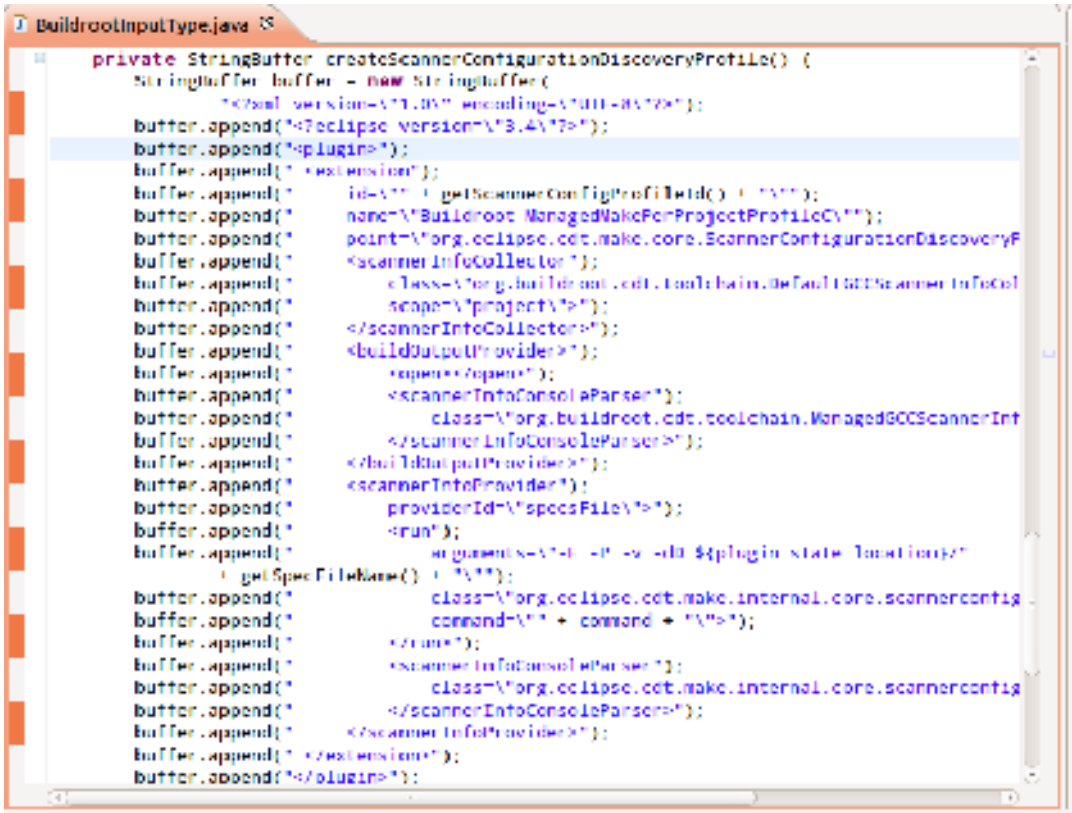
Buildroot Makefile integration demonstration

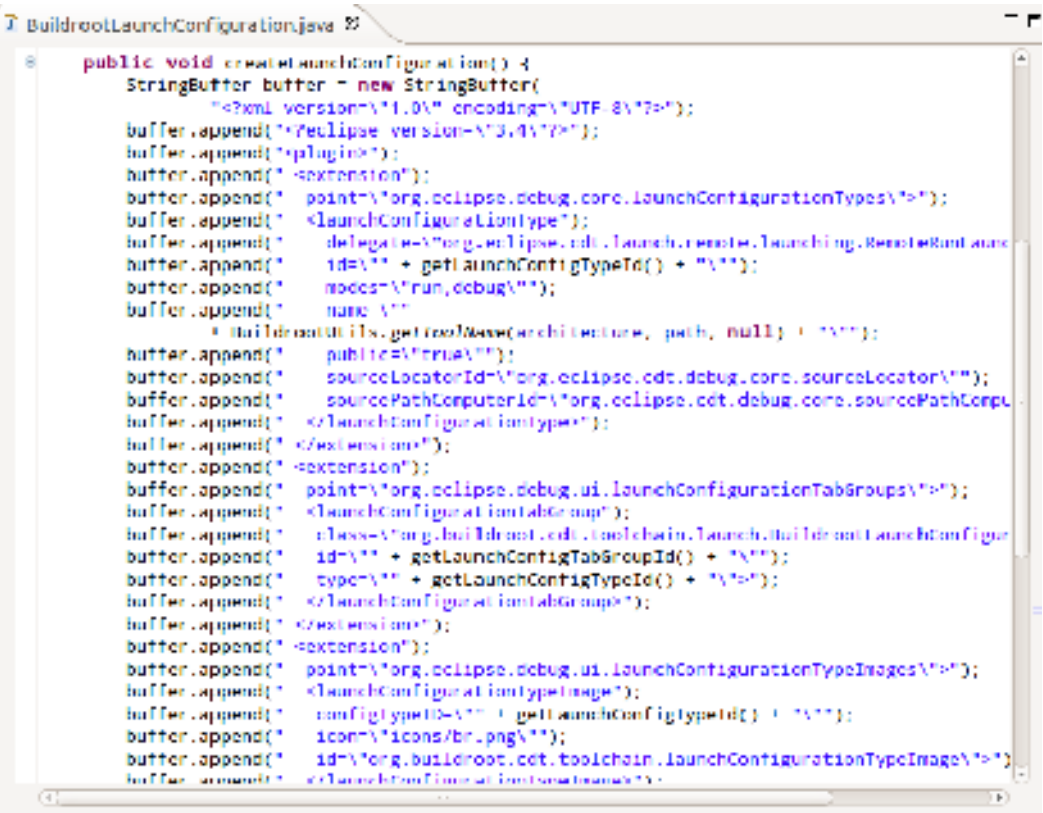
Integration with CDT : Issues

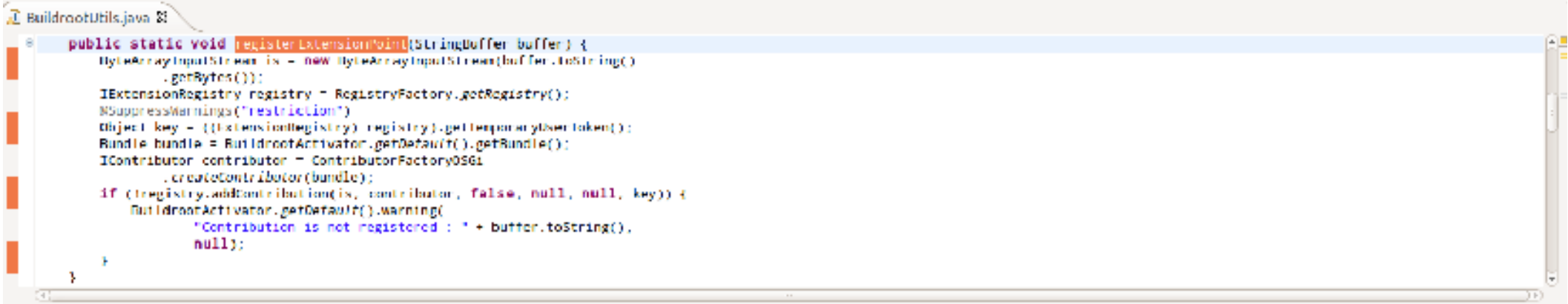


- V1.0 uses *dynamicElementProvider*
  - Method returning a hierarchy of objects implementing IManagedConfigElement
  - Contributing environment variables through configurationEnvironmentSupplier requires a DefaultManagedConfigElement
- Consequently for V2.0 build dynamically the plugin.xml
  - Use startup extension point ;(
  - Missing dynamic extension points in CDT ?
    - scanner configuration discovery profile
    - launch configuration

Integration with CDT







Buildroot Eclipse Update-site

- Update-site integrating embedded Linux tools :
  - Buildroot Toolchain Eclipse Plugin
  - Pkg-config
  - CDT
  - Linux tools
  - Autotools …
- Make a Ready-to-Use development platform for embedded Linux
- Use Tycho to create update-site

Availability

- Buildroot 2013.02 :

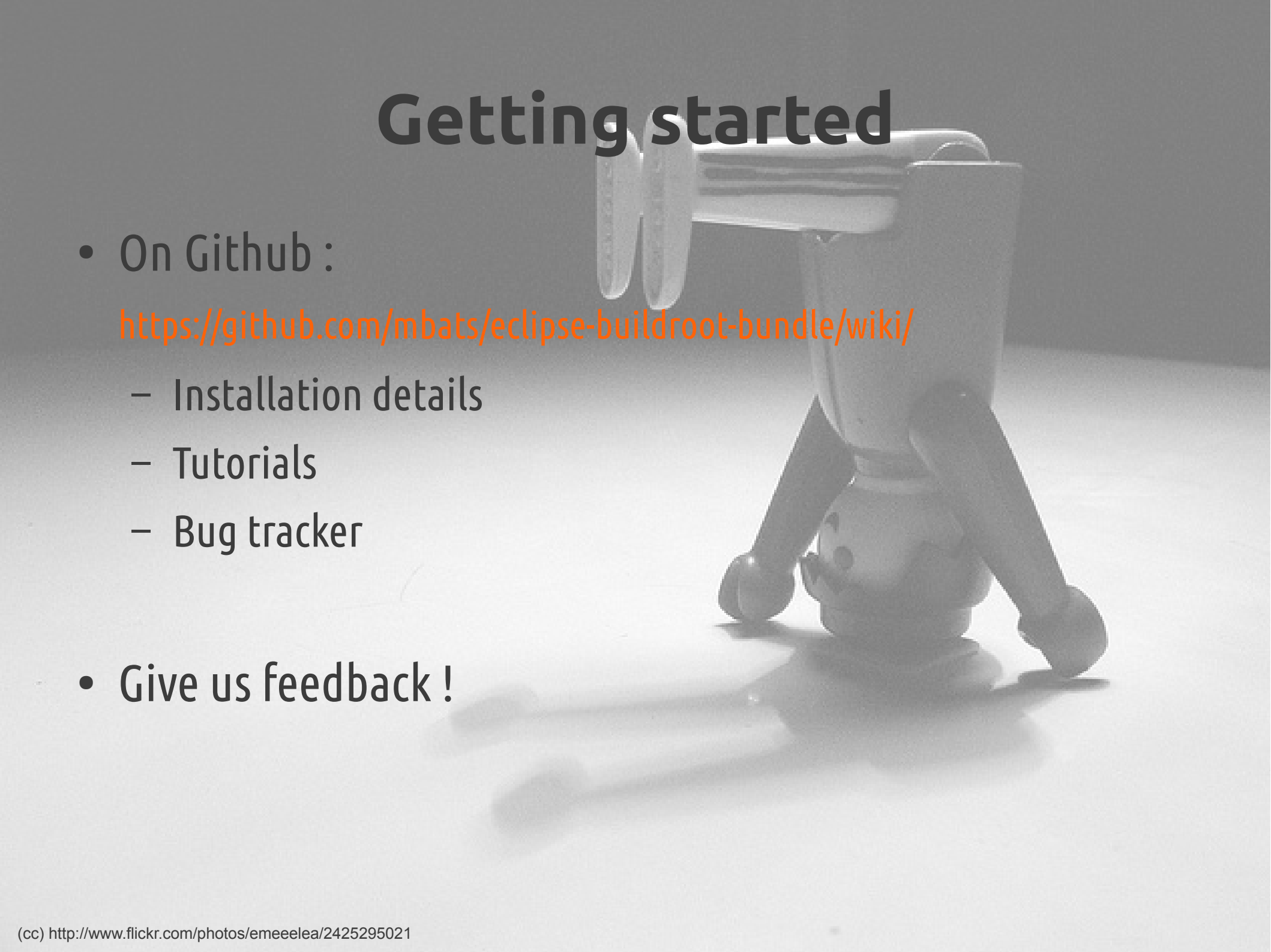
  http://buildroot.org

- Buildroot Eclipse plugin sources (EPL licence):
  https://github.com/mbats/eclipse-buildroot-toolchain-plugin
- Buildroot Eclipse bundle sources :
  https://github.com/mbats/eclipse-buildroot-bundle
- Pkg-config Eclipse plugin :

  http://code.google.com/p/pkg-config-support-for-eclipse-cdt/

- Buildroot Eclipse bundle update-site (based on Eclipse 4.2)

Getting started



- On Github :

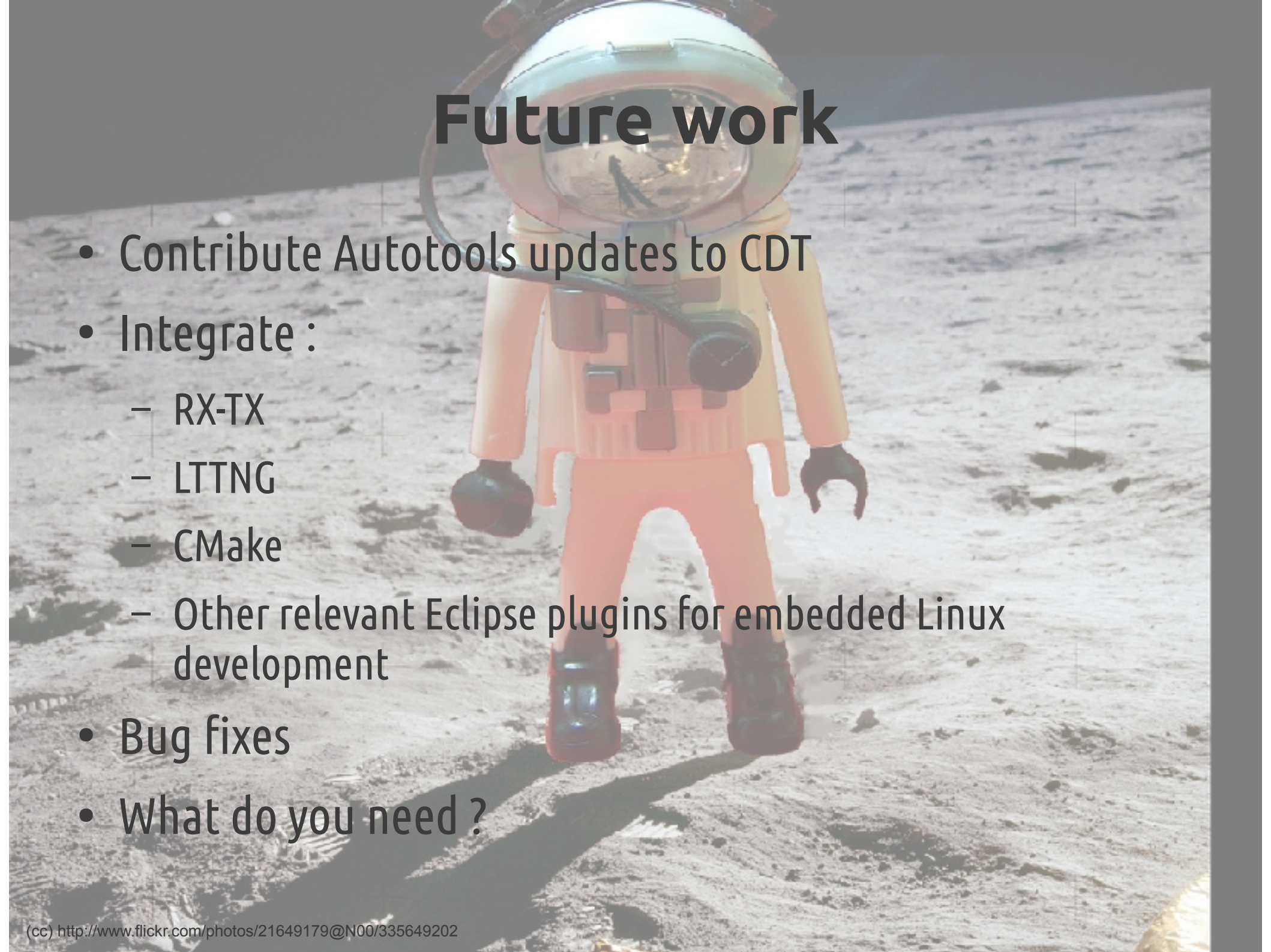
  https://github.com/mbats/eclipse-buildroot-bundle/wiki/

  - Installation details
  - Tutorials
  - Bug tracker

- Give us feedback !

Future work

- Contribute Autotools updates to CDT
- Integrate :
  - RX-TX
  - LTTNG
  - CMake
  - Other relevant Eclipse plugins for embedded Linux development
- Bug fixes
- What do you need ?




Questions ?
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