

Argh-P-M

Eine Reise durch das RPM-Dateiformat

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<https://dl.xyrillian.de/presentations/argh-p-m-german/slides.pdf>

Gliederung

1. Warum!?
2. Vernünftige Paketformate: .deb und .pkg.tar
3. Ein anderes Paketformat: .rpm
4. Lektion



HOLO

Minimalistic configuration management



Declarative

Document system configuration with a friendly DSL.



Integrated

Holo uses the system package manager to maintain the system state.



Serverless

No dedicated infrastructure, network access or permanently running agent required.

makepkg (Arch Linux) vs. holo-build

```
$ cat PKGBUILD
pkgname='hologram-base'
pkgver=1.0.0
pkgrel=1
pkgdesc='hologram: base config'
arch=('any')
url=''
license=('BSD')
depends=('glibc' 'systemd')
source=(
    'src/locale.gen'
    'src/vconsole.conf'
)

package() {
    install -D -m 0644 locale.conf \
        "${pkgdir}/etc/locale.conf"
    install -D -m 0644 vconsole.conf \
        "${pkgdir}/etc/vconsole.conf"
}

$ cat src/*
...
```

```
$ cat hologram-base.pkg.toml
[[package]]
name = "hologram-base"
version = "1.0.0"
description = "hologram: base config"
requires = [ "glibc", "systemd" ]

[[file]]
path = "/etc/locale.conf"
content = '''
    LANG=de_DE.UTF_8
    LC_MESSAGES=C
'''

[[file]]
path = "/etc/vconsole.conf"
content = '''
    FONT=latarcyrheb-sun16
    KEYMAP=de-latin1-nodeadkeys
'''
```

.deb: Dateistruktur

```
$ file -kr tree_1.7.0-3_amd64.deb
tree_1.7.0-3_amd64.deb: Debian binary package (format 2.0)
- current ar archive
- archive file
- data
```

.deb: Dateistruktur

```
$ file -kr tree_1.7.0-3_amd64.deb
tree_1.7.0-3_amd64.deb: Debian binary package (format 2.0)
- current ar archive
- archive file
- data

$ ar x tree_1.7.0-3_amd64.deb
$ ls
control.tar.gz  data.tar.xz  debian-binary  tree_1.7.0-3_amd64.deb

$ cat debian-binary
2.0
```

.deb: Dateistruktur

```
$ file -kr tree_1.7.0-3_amd64.deb
tree_1.7.0-3_amd64.deb: Debian binary package (format 2.0)
- current ar archive
- archive file
- data

$ ar x tree_1.7.0-3_amd64.deb
$ ls
control.tar.gz  data.tar.xz  debian-binary  tree_1.7.0-3_amd64.deb

$ cat debian-binary
2.0

$ tar tf control.tar.gz
./
./control
./md5sums

$ tar tf data.tar.xz | grep -v '/$'
./usr/bin/tree
./usr/share/doc/tree/copyright
./usr/share/doc/tree/TODO
./usr/share/doc/tree/changelog.Debian.gz
./usr/share/doc/tree/changelog.gz
./usr/share/doc/tree/README.gz
./usr/share/man/man1/tree.1.gz
```

.deb: Metadaten

```
$ tar 0xf control.tar.gz ./control | head
Package: tree
Version: 1.7.0-3
Architecture: amd64
Maintainer: Florian Ernst <florian@debian.org>
Installed-Size: 100
Depends: libc6 (≥ 2.14)
Section: utils
Priority: optional
Homepage: http://mama.indstate.edu/users/ice/tree/
Description: displays an indented directory tree, in color
```


.pkg.tar (Arch Linux)

```
$ tar tf tree-1.7.0-1-x86_64.pkg.tar.xz
.PKGINFO
.MTREE
usr/
usr/bin/
usr/share/
usr/share/man/
usr/share/man/man1/
usr/share/man/man1/tree.1.gz
usr/bin/tree
```

```
$ tar 0xf tree-1.7.0-1-x86_64.pkg.tar.xz .PKGINFO | head
# Generated by makepkg 4.1.2
# using fakeroot version 1.20
# Thu Apr 24 18:18:51 UTC 2014
pkgname = tree
pkgver = 1.7.0-1
pkgdesc = A directory listing program displaying a depth indented list of files
url = http://mama.indstate.edu/users/ice/tree/
builddate = 1398363531
packager = Giovanni Scafora <giovanni@archlinux.org>
size = 78848
```

.rpm: Erste Annäherung

```
$ file -kr tree-1.7.0-7.fc26.x86_64.rpm
tree-1.7.0-7.fc26.x86_64.rpm: RPM v3.0 bin i386/x86_64
- data
```

.rpm: Blick in die Spezifikation

Aus dem RPM-Abschnitt in LSB Core 5.0:

An RPM format file consists of 4 sections, the Lead, Signature, Header, and the Payload. All values are stored in network byte order.

.rpm: Lead-Sektion (1)

```
struct rpmllead {  
    unsigned char magic[4];  
    unsigned char major, minor;  
    short type;  
    short archnum;  
    char name[66];  
    short osnum;  
    short signature_type;  
    char reserved[16];  
};
```

.rpm: Lead-Sektion (2)

```
$ xxd tree-1.7.0-7.fc26.x86_64.rpm | head -n6
00000000: edab eedb 0300 0000 0001 7472 6565 2d31 .....tree-1
00000010: 2e37 2e30 2d37 2e66 6332 3600 0000 0000 .7.0-7.fc26.....
00000020: 0000 0000 0000 0000 0000 0000 0000 0000 .....
00000030: 0000 0000 0000 0000 0000 0000 0000 0000 .....
00000040: 0000 0000 0000 0000 0000 0000 0001 0005 .....
00000050: 0000 0000 0000 0000 0000 0000 0000 0000 .....
```

```
magic = "\xED\xAB\xEE\xDB"
major = 3
minor = 0
type = 0 // binary (1 = source)
archnum = 1 // x86
name = "tree-1.7.0-7.fc26"
osnum = 1 // Linux
signature_type = 5
```

.rpm: Header mit Headern

- ▶ Lead-Sektion (veraltet)
- ▶ Signatur-Sektion
 - ▶ Header der Signatur-Sektion
- ▶ Header-Sektion
 - ▶ Header der Header-Sektion

.rpm: Header mit Headern

- ▶ Lead-Sektion (veraltet)
- ▶ Signatur-Sektion
 - ▶ Header der Signatur-Sektion
- ▶ Header-Sektion
 - ▶ Header der Header-Sektion

```
struct rpmheader {  
    unsigned char magic[4]; // must be "\216\255\350\001"  
    unsigned char reserved[4]; // must be "\0\0\0\0"  
    int nindex; // number of index records  
    int hsize; // size of storage area for data  
};
```

```
struct rpmhdrindex {  
    int tag; // the key  
    int type; // data type  
    int offset; // where to find the data in the storage area  
    int count; // how many data items are stored in this key  
};
```

.rpm-Header: Basis-Metadaten (1)

```
tag 1000 (NAME): length 1
string: tree
tag 1001 (VERSION): length 1
string: 1.7.0
tag 1002 (RELEASE): length 1
string: 7.fc26
tag 1004 (SUMMARY): length 1
translatable string: File system tree viewer
tag 1005 (DESCRIPTION): length 1
translatable string: The tree utility recursively displays the contents of directories in a
tree-like format. Tree is basically a UNIX port of the DOS tree
utility.
tag 1009 (SIZE): length 1
int32: 99355
tag 1014 (LICENSE): length 1
string: GPLv2+
tag 1021 (OS): length 1
string: linux
tag 1022 (ARCH): length 1
string: x86_64
```


.rpm-Header: Basis-Metadaten (2)

```
tag 1010 (DISTRIBUTION): length 1
  string: Fedora Project
tag 1011 (VENDOR): length 1
  string: Fedora Project
tag 1015 (PACKAGER): length 1
  string: Fedora Project
```

.rpm-Header: Basis-Metadaten (2)

```
tag 1010 (DISTRIBUTION): length 1
  string: Fedora Project
tag 1011 (VENDOR): length 1
  string: Fedora Project
tag 1015 (PACKAGER): length 1
  string: Fedora Project

tag 1016 (GROUP): length 1
  translatable string: Applications/File
```

.rpm-Header: Basis-Metadaten (2)

```
tag 1010 (DISTRIBUTION): length 1
  string: Fedora Project
tag 1011 (VENDOR): length 1
  string: Fedora Project
tag 1015 (PACKAGER): length 1
  string: Fedora Project

tag 1016 (GROUP): length 1
  translatable string: Applications/File

tag 1020 (URL): length 1
  string: http://mama.indstate.edu/users/ice/tree/
```

.rpm-Header: Basis-Metadaten (2)

```
tag 1010 (DISTRIBUTION): length 1
  string: Fedora Project
tag 1011 (VENDOR): length 1
  string: Fedora Project
tag 1015 (PACKAGER): length 1
  string: Fedora Project

tag 1016 (GROUP): length 1
  translatable string: Applications/File

tag 1020 (URL): length 1
  string: http://mama.indstate.edu/users/ice/tree/

RPMTAG_URL - Generic package information URL
RPMTAG_DISTURL - URL for package
```

.rpm-Header: Build-Metadaten

```
tag 1006 (BUILDTIME): length 1
  int32: 1472740798
tag 1007 (BUILDHOST): length 1
  string: buildvm-23.phx2.fedoraproject.org
tag 1044 (SOURCERPM): length 1
  string: tree-1.7.0-7.fc26.src.rpm
tag 1064 (RPMVERSION): length 1
  string: 4.13.0-rc1
tag 1122 (OPTFLAGS): length 1
  string: -O2 -g -pipe -Wall -Werror=format-security -Wp,-D_FORTIFY_SOURCE=2 -fexceptions
    -fstack-protector-strong --param=ssp-buffer-size=4 -grecord-gcc-switches
    -specs=/usr/lib/rpm/redhat/redhat-hardened-cc1 -m64 -mtune=generic
tag 1132 (PLATFORM): length 1
  string: x86_64-redhat-linux-gnu
```

.rpm-Header: Abteilung für Redundanz

```
tag 1124 (PAYLOADFORMAT): length 1
  string: cpio
tag 1125 (PAYLOADCOMPRESSOR): length 1
  string: xz
tag 1126 (PAYLOADFLAGS): length 1
  string: 2
```

.rpm-Header: Abteilung für Redundanz

```
tag 1124 (PAYLOADFORMAT): length 1
  string: cpio
tag 1125 (PAYLOADCOMPRESSOR): length 1
  string: xz
tag 1126 (PAYLOADFLAGS): length 1
  string: 2
```

RPMTAG_PAYLOADFLAGS - This tag indicates the compression level used for the Payload.

.rpm-Header: Changelogs

```
tag 1080 (CHANGELOGTIME): length 70
  int32: 1472731200
  int32: 1454673600
  int32: 1434715200
  [...]
tag 1081 (CHANGELOGNAME): length 70
  string: Kamil Dudka <kdudka@redhat.com> - 1.7.0-7
  string: Fedora Release Engineering <releng@fedoraproject.org> - 1.7.0-6
  string: Fedora Release Engineering <rel-eng@lists.fedoraproject.org> - 1.7.0-5
  [...]
tag 1082 (CHANGELOGTEXT): length 70
  string: - drop a non-upstream patch that disabled color output by default (#1284657)
  string: - Rebuilt for https://fedoraproject.org/wiki/Fedora\_24\_Mass\_Rebuild
  string: - Rebuilt for https://fedoraproject.org/wiki/Fedora\_23\_Mass\_Rebuild
  [...]
```


Paketrelationen: Überblick

Semantik einer Relation zu X in Y:

- ▶ **Depends:** X muss installiert sein, wenn Y installiert wird.
- ▶ **Provides:** Umkehrung, Y kann ein Depends auf X erfüllen.
- ▶ **Conflicts:** X und Y können nicht gleichzeitig installiert sein.
- ▶ **Replaces:** X wird beim Upgrade durch Y ersetzt.

.rpm-Header: Paketrelationen (1)

```
tag 1047 (PROVIDENAME): length 2
  string: tree
  string: tree(x86-64)
tag 1112 (PROVIDEFLAGS): length 2
  int32: 8 = 0x8 = 0o10
  int32: 8 = 0x8 = 0o10
tag 1113 (PROVIDEVERSION): length 2
  string: 1.7.0-7.fc26
  string: 1.7.0-7.fc26
```

Dieselben Paketrelationen in einem .deb-Paket

.rpm-Header: Paketrelationen (1)

```
tag 1047 (PROVIDENAME): length 2
  string: tree
  string: tree(x86-64)
tag 1112 (PROVIDEFLAGS): length 2
  int32: 8 = 0x8 = 0o10
  int32: 8 = 0x8 = 0o10
tag 1113 (PROVIDEVERSION): length 2
  string: 1.7.0-7.fc26
  string: 1.7.0-7.fc26
```

.rpm-Header: Paketrelationen (2)

```
enum rpmsenseFlags_e {
    RPMSENSE_ANY          = 0,
    RPMSENSE_LESS        = (1 << 1),
    RPMSENSE_GREATER     = (1 << 2),
    RPMSENSE_EQUAL       = (1 << 3),
    /* bit 4 unused */
    RPMSENSE_POSTTRANS   = (1 << 5),      /*!< %posttrans dependency */
    RPMSENSE_PREREQ      = (1 << 6),      /* legacy prereq dependency */
    RPMSENSE_PRETRANS    = (1 << 7),      /*!< Pre-transaction dependency. */
    RPMSENSE_INTERP      = (1 << 8),      /*!< Interpreter used by scriptlet. */
    RPMSENSE_SCRIPT_PRE  = (1 << 9),      /*!< %pre dependency. */
    RPMSENSE_SCRIPT_POST = (1 << 10),     /*!< %post dependency. */
    RPMSENSE_SCRIPT_PREUN = (1 << 11),    /*!< %preun dependency. */
    RPMSENSE_SCRIPT_POSTUN = (1 << 12),   /*!< %postun dependency. */
    RPMSENSE_SCRIPT_VERIFY = (1 << 13),  /*!< %verify dependency. */
    RPMSENSE_FIND_REQUIRES = (1 << 14),  /*!< find-requires generated dependency. */
    RPMSENSE_FIND_PROVIDES = (1 << 15),  /*!< find-provides generated dependency. */

    RPMSENSE_TRIGGERIN   = (1 << 16),    /*!< %triggerin dependency. */
    RPMSENSE_TRIGGERUN   = (1 << 17),    /*!< %triggerun dependency. */
    RPMSENSE_TRIGGERPOSTUN = (1 << 18),  /*!< %triggerpostun dependency. */
    RPMSENSE_MISSINGOK   = (1 << 19),    /*!< suggests/enhances hint. */
    /* bits 20-23 unused */
    RPMSENSE_RPMLIB      = (1 << 24),    /*!< rpmlib(feature) dependency. */
    RPMSENSE_TRIGGERPREIN = (1 << 25),   /*!< %triggerprein dependency. */
    RPMSENSE_KEYRING     = (1 << 26),
    /* bit 27 unused */
    RPMSENSE_CONFIG      = (1 << 28)
};
```

.rpm-Header: Paketrelationen (3)

```
tag 1048 (REQUIREFLAGS): length 11
  int32: 16384 = 0x4000 = 0o40000
  int32: 16384 = 0x4000 = 0o40000
  int32: 16384 = 0x4000 = 0o40000
  int32: 16384 = 0x4000 = 0o40000
  int32: 16384 = 0x4000 = 0o40000
  int32: 16384 = 0x4000 = 0o40000
  int32: 16777226 = 0x100000A = 0o100000012
  int32: 16777226 = 0x100000A = 0o100000012
  int32: 16777226 = 0x100000A = 0o100000012
  int32: 16777226 = 0x100000A = 0o100000012
  int32: 16384 = 0x4000 = 0o40000
tag 1049 (REQUIRENAME): length 11
  string: libc.so.6()(64bit)
  string: libc.so.6(GLIBC_2.14)(64bit)
  string: libc.so.6(GLIBC_2.2.5)(64bit)
  string: libc.so.6(GLIBC_2.3)(64bit)
  string: libc.so.6(GLIBC_2.3.4)(64bit)
  string: libc.so.6(GLIBC_2.4)(64bit)
  string: rpmlib(CompressedFileNames)
  string: rpmlib(FileDigests)
  string: rpmlib(PayloadFilesHavePrefix)
  string: rpmlib(PayloadIsXz)
  string: rtd(GNU_HASH)
tag 1050 (REQUIREVERSION): length 11
  string:
  string:
  string:
  string:
  string:
  string:
  string: 3.0.4-1
  string: 4.6.0-1
  string: 4.0-1
  string: 5.2-1
```

.rpm-Header: Paketrelationen (4)

```
libc.so.6()(64bit) = <empty> // find-requires generated dependency
libc.so.6(GLIBC_2.14)(64bit) = <empty> // find-requires generated dependency
libc.so.6(GLIBC_2.2.5)(64bit) = <empty> // find-requires generated dependency
libc.so.6(GLIBC_2.3)(64bit) = <empty> // find-requires generated dependency
libc.so.6(GLIBC_2.3.4)(64bit) = <empty> // find-requires generated dependency
libc.so.6(GLIBC_2.4)(64bit) = <empty> // find-requires generated dependency
rpmlib(CompressedFileNames) = 3.0.4-1 // rpmlib(feature) dependency
rpmlib(FileDigests) = 4.6.0-1 // rpmlib(feature) dependency
rpmlib(PayloadFilesHavePrefix) = 4.0-1 // rpmlib(feature) dependency
rpmlib(PayloadIsXz) = 5.2-1 // rpmlib(feature) dependency
rtld(GNU_HASH) = <empty> // find-requires generated dependency
```

.rpm-Header: Datei-Metadaten (1)

```
tag 1028 (FILESIZES): length 5
  int32: 71296
  int32: 4096
  int32: 18009
  int32: 5620
  int32: 4430
tag 1030 (FILEMODES): length 5
  int16: 0o100755
  int16: 0o40755
  int16: 0o100644
  int16: 0o100644
  int16: 0o100644
tag 1033 (FILERDEVS): length 5
  int16: 0
  int16: 0
  int16: 0
  int16: 0
tag 1034 (FILETIMES): length 5
  int32: 1472740798
  int32: 1472740798
  int32: 1092343095
  int32: 1398112287
  int32: 1398281952
tag 1035 (FILEMD5S): length 5
  string: 14c9b283109f49724b561a422ef6db0e7f6092572789b594c4c758b4af1cb19a
  string:
  string: 204d8eff92f95aac4df6c8122bc1505f468f3a901e5a4cc08940e0ede1938994
  string: 5e703bb68f8a0bc6eb22433a825e36609562668f311605c46af31a25f7a95c08
  string: bbcd538f8da16fb0a6847a71b06272f155dd5becff44bc2cf8eaf72b3c3a76c4
```


.rpm-Header: Datei-Metadaten (2)

```
tag 1036 (FILELINKTOS): length 5
  string:
  string:
  string:
  string:
  string:
tag 1037 (FILEFLAGS): length 5
  int32: 0
  int32: 0
  int32: 2
  int32: 2
  int32: 2
tag 1039 (FILEUSERNAME): length 5
  string: root
  string: root
  string: root
  string: root
  string: root
tag 1040 (FILEGROUPNAME): length 5
  string: root
  string: root
  string: root
  string: root
  string: root
tag 1045 (FILEVERIFYFLAGS): length 5
  int32: -1
  int32: -1
  int32: -1
  int32: -1
  int32: -1
```

.rpm-Header: Datei-Metadaten (3)

```
tag 1095 (FILEDEVICES): length 5
  int32: 1
  int32: 1
  int32: 1
  int32: 1
  int32: 1
tag 1096 (FILEINODES): length 5
  int32: 1
  int32: 2
  int32: 3
  int32: 4
  int32: 5
tag 1097 (FILELANGS): length 5
  string:
  string:
  string:
  string:
  string:
tag 1140 (FILECOLORS): length 5
  int32: 2
  int32: 0
  int32: 0
  int32: 0
  int32: 0
tag 1141 (FILECLASS): length 5
  int32: 0
  int32: 1
  int32: 2
  int32: 2
  int32: 3
```

.rpm-Header: Datei-Metadaten (4)

```
tag 1143 (FILEDEPENDSX): length 5
  int32: 0
  int32: 0
  int32: 0
  int32: 0
  int32: 0
tag 1144 (FILEDEPENDSN): length 5
  int32: 7
  int32: 0
  int32: 0
  int32: 0
  int32: 0
tag 5011 (FILEDIGESTALGO): length 1
  int32: 80
```

.rpm-Header: Datei-Metadaten (5)

```
tag 1027 (OLDFILENAMES): length 5  
string: /usr/bin/tree  
string: /usr/share/doc/tree  
string: /usr/share/doc/tree/LICENSE  
string: /usr/share/doc/tree/README  
string: /usr/share/man/man1/tree.1.gz
```

.rpm-Header: Datei-Metadaten (5)

```
tag 1027 (OLDFILENAMES): length 5
string: /usr/bin/tree
string: /usr/share/doc/tree
string: /usr/share/doc/tree/LICENSE
string: /usr/share/doc/tree/README
string: /usr/share/man/man1/tree.1.gz
```

```
tag 1117 (BASENAMES): length 5
string: tree
string: tree
string: LICENSE
string: README
string: tree.1.gz
```

```
tag 1116 (DIRINDEXES): length 5
int32: 0
int32: 1
int32: 2
int32: 2
int32: 3
```

```
tag 1118 (DIRNAMES): length 4
string: /usr/bin/
string: /usr/share/doc/
string: /usr/share/doc/tree/
string: /usr/share/man/man1/
```

.rpm-Header: Header in Header in Header

```
tag 63 (HEADERIMMUTABLE): length 16
  00000000 00 00 00 3f 00 00 00 07 ff ff fc 60 00 00 00 10 |...?......'....|
```

.rpm-Header: Header in Header in Header

```
tag 63 (HEADERIMMUTABLE): length 16
  00000000 00 00 00 3f 00 00 00 07 ff ff fc 60 00 00 00 10 |...?......'....|
```

RPMTAG_HEADERIMMUTABLE - This tag contains an index record which specifies the portion of the Header Record which was used for the calculation of a signature. This data shall be preserved or any header-only signature will be invalidated.

```
tag    = 0x3f      // RPMTAG_HEADERIMMUTABLE
type   = 0x7       // BIN
offset = 0xfffffc60 // -928 bytes
count  = 0x10      // 16 records
```

.rpm-Signaturheader

```
tag 62 (HEADERSIGNATURES): length 16  
00000000 00 00 00 3e 00 00 00 07 ff ff ff 80 00 00 00 10 |...>.....|
```


.rpm-Signaturheader

```
tag 62 (HEADERSIGNATURES): length 16
  00000000 00 00 00 3e 00 00 00 07 ff ff ff 80 00 00 00 10 |...>.....|

tag 269 (SHA1): length 1
string: 268371792c4ffd4e716111a182176c6922ae55ce

tag 1004 (MD5): length 16
  00000000 27 54 c3 9e 94 8e 68 d5 1e aa a9 82 8f 5c df 4c |'T....h.....\..L|
```

.rpm-Signaturheader

```
tag 62 (HEADERSIGNATURES): length 16
  00000000 00 00 00 3e 00 00 00 07 ff ff ff 80 00 00 00 10 |...>.....|

tag 269 (SHA1): length 1
string: 268371792c4ffd4e716111a182176c6922ae55ce
tag 1004 (MD5): length 16
  00000000 27 54 c3 9e 94 8e 68 d5 1e aa a9 82 8f 5c df 4c |'T....h.....\L|

tag 1000 (SIZE): length 1
int32: 52270
tag 1007 (PAYLOADSIZE): length 1
int32: 100168
```

.rpm-Signaturheader

```
tag 62 (HEADERSIGNATURES): length 16
  00000000 00 00 00 3e 00 00 00 07 ff ff ff 80 00 00 00 10 |...>.....|

tag 269 (SHA1): length 1
  string: 268371792c4ffd4e716111a182176c6922ae55ce
tag 1004 (MD5): length 16
  00000000 27 54 c3 9e 94 8e 68 d5 1e aa a9 82 8f 5c df 4c |'T....h.....\..L|

tag 1000 (SIZE): length 1
  int32: 52270
tag 1007 (PAYLOADSIZE): length 1
  int32: 100168

tag 268 (RSA): length 536
  00000000 89 02 15 03 05 00 57 da 83 60 81 2a 6b 4b 64 da |.....W..'.*kKd.|
  00000010 b8 5d 01 08 dc 84 0f ff 47 5b c6 39 93 c2 9d 75 |.].....G[.9...u|
  00000020 90 cf b5 66 8e df fe 7c 62 37 a0 7f 3c 5d f2 80 |...f...|b7..<]..|
  [...]

tag 1002 (PGP): length 536
  00000000 89 02 15 03 05 00 57 da 83 60 81 2a 6b 4b 64 da |.....W..'.*kKd.|
  00000010 b8 5d 01 08 81 bb 10 00 80 f4 79 e8 cc 6a f9 3b |.].....y..j.;|
  00000020 be 2c 52 cb a6 2b 0a 7d 43 9b 4c 6f 41 94 e6 24 |.,R...+.}C.LoA..$|
  [...]
```

.rpm-Header: Erweiterbarkeit

tag 1008 (RESERVEDSPACE): length 4096

```
00000000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
00000010 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
00000020 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
00000030 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
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00000060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
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00000090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
000000a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
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00000100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
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00000180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
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000001b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
000001c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
[...]
```

```
00000fd0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
00000fe0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
00000ff0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | .....|
```

.rpm-Header: Falsche Farbe

```
/**
 * File States (when installed).
 */
typedef enum rpmfileState_e {
    RPMFILE_STATE_MISSING      = -1, /* used for unavailable data */
    RPMFILE_STATE_NORMAL      = 0,
    RPMFILE_STATE_REPLACED    = 1,
    RPMFILE_STATE_NOTINSTALLED = 2,
    RPMFILE_STATE_NETSHARED   = 3,
    RPMFILE_STATE_WRONGCOLOR  = 4
} rpmfileState;
```

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- ▶ Den Code anderer lesen trainiert den guten Geschmack.