A year of fixing Coverity issues all over the Linux kernel

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The Linux Foundation's Core Infrastructure Initiative

Kernel Recipes
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Agenda

- Coverity.
- Bugfixes.
- Workflow.
- Contributions.
- Results.
- Bonus.

Coverity

- Static code analyzer.
- Performs analysis without running the code.
- Tons of false positives (This applies to all static code analyzers).

Coverity high impact issues

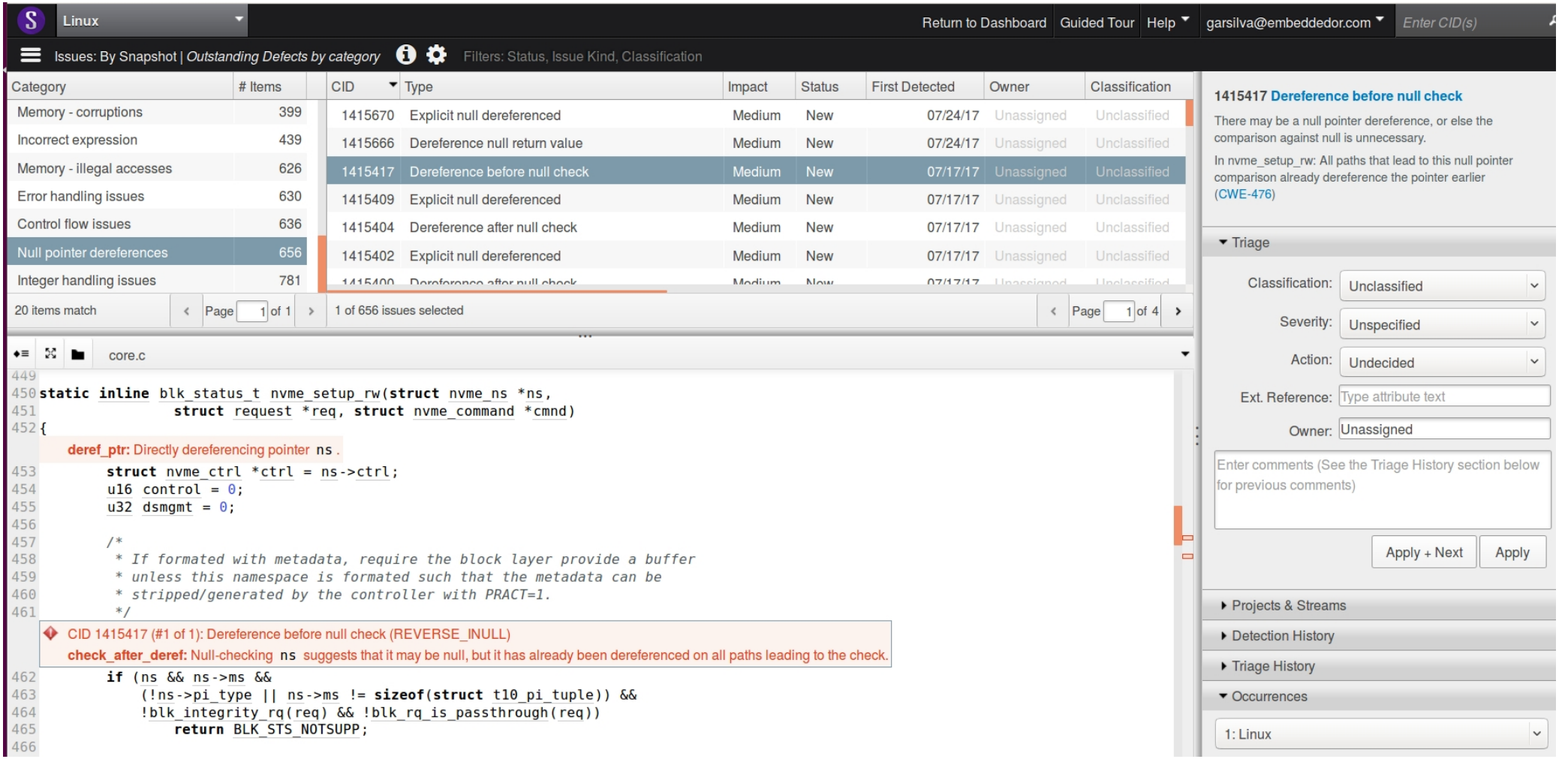
- Memory – illegal accesses (out-of-bounds access).
- Resource leaks (memory leaks).
- Uninitialized variables.

Coverity medium impact issues

- NULL pointer dereferences (before/after null check, explicit null dereference).
- Integer handling issues (bad bit shift operation).
- API usage errors (arguments in wrong order).
- Control flow issues.

Interface

- https://scan.coverity.com/projects?utf8=%E2%9C%93&search=linux



Bugfixes

Fix type of variable

- commit fe78627d430435d22316fe39f2012ece31bf23c2

Diffstat

-rw-r--r-- drivers/gpu/drm/amd/display/dc/dce110/dce110_compressor.c 2

1 files changed, 1 insertions, 1 deletions

```
diff --git a/drivers/gpu/drm/amd/display/dc/dce110/dce110_compressor.c
index e2994d337044..111c4921987f 100644
--- a/drivers/gpu/drm/amd/display/dc/dce110/dce110_compressor.c
+++ b/drivers/gpu/drm/amd/display/dc/dce110/dce110_compressor.c
@@ -143,7 +143,7 @@ static void wait_for_fbc_state_changed(
        struct dce110_compressor *cp110,
        bool enabled)
 {
-       uint8_t counter = 0;
+       uint16_t counter = 0;
        uint32_t addr = mmFBC_STATUS;
        uint32_t value;
```

Fix type of variable

- commit 2b6199a1d1b70fccd62aed961ba4c2b979ae499c

```
diff --git a/drivers/gpu/drm/amd/display/dc/dce110/dce110_compressor.c b/drivers/gpu/drm/
index 9150d26..e2994d3 100644
--- a/drivers/gpu/drm/amd/display/dc/dce110/dce110_compressor.c
+++ b/drivers/gpu/drm/amd/display/dc/dce110/dce110_compressor.c
@@ -121,10 +121,10 @@ static void reset_lb_on_vblank(struct dc_context *ctx)
                frame_count = dm_read_reg(ctx, mmCRTC_STATUS_FRAME_COUNT);


-               for (retry = 100; retry > 0; retry--) {
+               for (retry = 10000; retry > 0; retry--) {
                        if (frame_count != dm_read_reg(ctx, mmCRTC_STATUS_FRAME_COUNT))
                                break;
-                       msleep(1);
+                       udelay(10);
                }
                if (!retry)
                        dm_error("Frame count did not increase for 100ms.\n");
@@ -147,14 +147,14 @@ static void wait_for_fbc_state_changed(
        uint32_t addr = mmFBC_STATUS;
        uint32_t value;

-       while (counter < 10) {
+       while (counter < 1000) {
                value = dm_read_reg(cp110->base.ctx, addr);
                if (get_reg_field_value(
                        value,
                        FBC_STATUS,
                        FBC_ENABLE_STATUS) == enabled)
                        break;
-               msleep(10);
+               udelay(100);
                counter++;
        }
```

Inconsistent IS_ERR and PTR_ERR

- commit 2b7db29b79190f7ad5c32f63594ba08b9b9171ea

Diffstat

-rw-r--r-- drivers/staging/media/imx/imx-media-csi.c 2

1 files changed, 1 insertions, 1 deletions

```
diff --git a/drivers/staging/media/imx/imx-media-csi.c b/drivers/staging/media/ir
index 16cab40156ca..aeab05f682d9 100644
--- a/drivers/staging/media/imx/imx-media-csi.c
+++ b/drivers/staging/media/imx/imx-media-csi.c
@@ -1799,7 +1799,7 @@ static int imx_csi_probe(struct platform_device *pdev)
        priv->dev->of_node = pdata->of_node;
        pinctrl = devm_pinctrl_get_select_default(priv->dev);
        if (IS_ERR(pinctrl)) {
-               ret = PTR_ERR(priv->vdev);
+               ret = PTR_ERR(pinctrl);
                dev_dbg(priv->dev,
                        "devm_pinctrl_get_select_default() failed: %d\n", ret);
                if (ret != -ENODEV)
```

Inconsistent IS_ERR and PTR_ERR

- commit 52e17089d1850774d2ef583cdef2b060b84fca8c

```
@@ -1797,6 +1796,10 @@ static int imx_csi_probe(struct platform_device *pdev)
         */
        priv->dev->of_node = pdata->of_node;
        pinctrl = devm_pinctrl_get_select_default(priv->dev);
+       if (IS_ERR(pinctrl)) {
+               ret = PTR_ERR(priv->vdev);
+               goto free;
+       }

        ret = v4l2_async_register_subdev(&priv->sd);
        if (ret)
```

Logically and structurally dead code

- commit 3f1109d1324405eaeb6c4a586084bd1d933d8b19

Diffstat

-rw-r--r-- drivers/mmc/host/sdhci-cadence.c 4

1 files changed, 2 insertions, 2 deletions

```
diff --git a/drivers/mmc/host/sdhci-cadence.c b/drivers/mmc/host/sdhci-cadence.c
index bc30d1637246..7a343b87b5e5 100644
--- a/drivers/mmc/host/sdhci-cadence.c
+++ b/drivers/mmc/host/sdhci-cadence.c
@@ -274,8 +274,8 @@ static int sdhci_cdns_set_tune_val(struct sdhci_host *host, u
                ret = readl_poll_timeout(reg, tmp,
                                         !(tmp & SDHCI_CDNS_HRS06_TUNE_UP),
                                         0, 1);
-
-               return ret;
+               if (ret)
+                       return ret;
        }

        return 0;
```

Logically and structurally dead code

- commit ef6b75671b5f6bfeb5e59e2829643483a3af8c39

```
+       /*
+        * Workaround for IP errata:
+        * The IP6116 SD/eMMC PHY design has a timing issue on receive data
+        * path. Send tune request twice.
+        */
+       for (i = 0; i < 2; i++) {
+               tmp |= SDHCI_CDNS_HRS06_TUNE_UP;
+               writel(tmp, reg);
+
+               ret = readl_poll_timeout(reg, tmp,
+                                        !(tmp & SDHCI_CDNS_HRS06_TUNE_UP),
+                                        0, 1);
+
+               return ret;
+       }
+
+       return 0;
 }
```

Infinite loop and out-of-bounds access

- commit ad109ba1378679f922f7286e7a9e50e2be778d87

Diffstat

-rw-r--r-- drivers/staging/wilc1000/wilc_wfi_cfgoperations.c 2

1 files changed, 1 insertions, 1 deletions

```
diff --git a/drivers/staging/wilc1000/wilc_wfi_cfgoperations.c
index 92322d6f061d..d6401a04fe3f 100644
--- a/drivers/staging/wilc1000/wilc_wfi_cfgoperations.c
+++ b/drivers/staging/wilc1000/wilc_wfi_cfgoperations.c
@@ -608,7 +608,7 @@ wilc_wfi_cfg_alloc_fill_ssid(struct cfg8021

 out_free:

-       for (i = 0; i < slot_id ; i--)
+       for (i = 0; i < slot_id; i++)
                kfree(ntwk->net_info[i].ssid);

        kfree(ntwk->net_info);
```

Multiple potential integer overflows

- commit 6f3472a993e7cb63cde5d818dcabc8e42fc03744

Diffstat

-rw-r--r-- drivers/gpu/drm/amd/display/dc/dce/dce_clock_source.c 10

1 files changed, 5 insertions, 5 deletions

```
diff --git a/drivers/gpu/drm/amd/display/dc/dce/dce_clock_source.c b/drivers/gpu
index 88b09dd758ba..ca137757a69e 100644
--- a/drivers/gpu/drm/amd/display/dc/dce/dce_clock_source.c
+++ b/drivers/gpu/drm/amd/display/dc/dce/dce_clock_source.c
@@ -133,7 +133,7 @@ static bool calculate_fb_and_fractional_fb_divider(
        uint64_t feedback_divider;

        feedback_divider =
-               (uint64_t)(target_pix_clk_khz * ref_divider * post_divider);
+               (uint64_t)target_pix_clk_khz * ref_divider * post_divider;
        feedback_divider *= 10;
        /* additional factor, since we divide by 10 afterwards */
        feedback_divider *= (uint64_t)(calc_pll_cs->fract_fb_divider_factor);

 @@ -203,8 +203,8 @@ static bool calc_fb_divider_checking_tolerance(
                        &fract_feedback_divider);

         /*Actual calculated value*/
 -       actual_calc_clk_khz = (uint64_t)(feedback_divider *
 -                                       calc_pll_cs->fract_fb_divider_factor) +
 +       actual_calc_clk_khz = (uint64_t)feedback_divider *
 +                                       calc_pll_cs->fract_fb_divider_factor +
                                                fract_feedback_divider;
         actual_calc_clk_khz *= calc_pll_cs->ref_freq_khz;
         actual_calc_clk_khz =
```

Fix use-after-free

- commit 594619497f3d6d4b8d8440e6d380e8da9dcc9eeb

Diffstat

-rw-r--r-- drivers/net/ethernet/mellanox/mlx5/core/fpga/ipsec.c 3

1 files changed, 2 insertions, 1 deletions

```
diff --git a/drivers/net/ethernet/mellanox/mlx5/core/fpga/ipsec.c b/drivers
index 4f1568528738..0f5da499a223 100644
--- a/drivers/net/ethernet/mellanox/mlx5/core/fpga/ipsec.c
+++ b/drivers/net/ethernet/mellanox/mlx5/core/fpga/ipsec.c
@@ -1061,8 +1061,9 @@ static int fpga_ipsec_fs_create_fte(struct mlx5_core_

        rule->ctx = mlx5_fpga_ipsec_fs_create_sa_ctx(dev, fte, is_egress);
        if (IS_ERR(rule->ctx)) {
+               int err = PTR_ERR(rule->ctx);
                kfree(rule);
-               return PTR_ERR(rule->ctx);
+               return err;
        }

        rule->fte = fte;
```

Fix missing return in switch

- commit c5b974bee9d2ceae4c441ae5a01e498c2674e100

Diffstat

-rw-r--r-- drivers/iio/accel/sca3000.c 1

1 files changed, 1 insertions, 0 deletions

```
diff --git a/drivers/iio/accel/sca3000.c b/drivers/iio/accel/sca3000.c
index 4dceb75e3586..4964561595f5 100644
--- a/drivers/iio/accel/sca3000.c
+++ b/drivers/iio/accel/sca3000.c
@@ -797,6 +797,7 @@ static int sca3000_write_raw(struct iio_dev *indio_dev,
                mutex_lock(&st->lock);
                ret = sca3000_write_3db_freq(st, val);
                mutex_unlock(&st->lock);
+               return ret;
        default:
                return -EINVAL;
        }
```

Workflow

Workflow

- Review daily Coverity report.

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- Review daily Coverity report.
- Build and run Smatch regularly.

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- Implement and run Coccinelle scripts.

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- Wake up 6AM in the morning.

Workflow

- Review daily Coverity report.
- Build and run Smatch regularly.
- Implement and run Coccinelle scripts.
- Wake up 6AM in the morning.
- Drink tons of coffee.

Contributions

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200+ patches upstream (KR2017)

Contributions

200+ patches upstream (KR2017)

750+ patches upstream (KR2018)

Contributions

- -Wimplicit-fallthrough

Contributions

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  $ git log --shortstat --author="Gustavo A. R. Silva" | grep fall-through | wc -l

  274

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  274 (~30%)

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  274 (~30%)

- Coccinelle (Happy 10th anniversary!)

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  274 (~30%)

- Coccinelle (Happy 10th anniversary!)

  $ git log --shortstat --author="Gustavo A. R. Silva" | grep Coccinelle | wc -l

  222

Contributions

- -Wimplicit-fallthrough

  $ git log --shortstat --author="Gustavo A. R. Silva" | grep fall-through | wc -l

  274 (~30%)

- Coccinelle (Happy 10th anniversary!)

  $ git log --shortstat --author="Gustavo A. R. Silva" | grep Coccinelle | wc -l

  222 (~30%)

Results

Categories (10+)

- NULL pointer dereferences.
- Spectre vulnerabilities.
- API usage errors.
- Code maintainability issues.
- Constification.
- Control flow issues.
- Uninitialized variables.
- Incorrect expression.
- Integer handling issues.
- Miscellaneous

Types (38+)

- Variable Length Arrays (VLA)
- Integer overflows
- Bad memory allocation
- Dereference after null check.
- Dereference before null check.
- Dereference null return value.
- Explicit null dereference.
- Missing null check on return value.
- Arguments in wrong order.
- Ignored error return code.
- Unused value.
- Unused code.
- Unnecessary static on local variable.
- Missing return in switch
- Logical vs. bitwise operator
- Wrong operator used
- Spectre V1
- Memory leaks
- ‘Constant’ variable guards dead code.
- Missing break in switch.
- Uninitialized scalar variable.
- Array compared against 0.
- Identical code for different branches.
- Self assignment.
- Macro compares unsigned to 0.
- Code refactoring.
- Print error message on failure.
- Unnecessary cast on kmalloc.
- Use sizeof(*var) in kmalloc.
- Double free
- Copy-paste errors
- Read from pointer after free

Subsystems & Components impacted (38+)

- alsa-devel
- linux-arm-msm
- linux-mediatek
- linux-samsung-soc
- ath10k
- linux-block
- linux-mmc
- linux-scsi
- ceph-devel
- linux-clk
- linux-nfs
- linux-wireless
- linux-media
- cifs-client
- linux-crypto
- linux-omap
- linux-wpan
- dri-devel
- linux-dmaengine
- linux-parisc
- platform-driver-x86
- intel-gfx
- linux-fbdev
- linux-pci
- spi-devel-general
- linux-arm-kernel
- kvm
- linux-fpga
- linux-pm
- target-devel
- linux-acpi
- linux-iio
- linux-rdma
- tpmdd-devel
- linux-rockchip
- linux-input
- linux-renesas-soc
- xen-devel

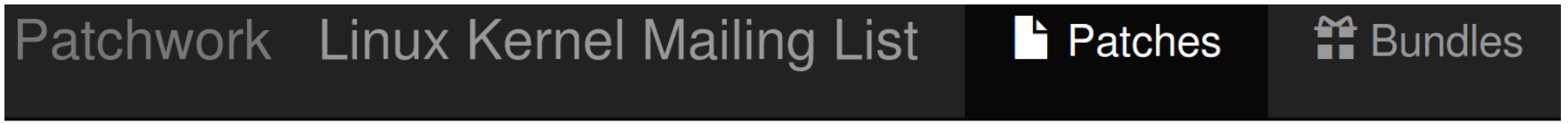
Stable trees impacted (14)

- 4.18.y
- 4.17.y
- 4.16.y
- 4.15.y
- 4.14.y *
- 4.13.y
- 4.12.y
- 4.11.y
- 4.10.y
- 4.9.y
- 4.4.y
- 4.1.y
- 3.18.y
- 3.16.y

Bonus

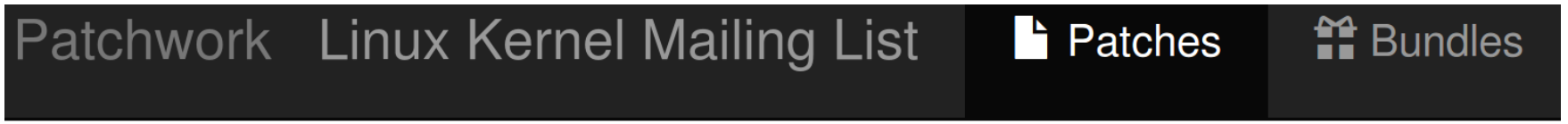
My experience with CoC

My experience with CoC



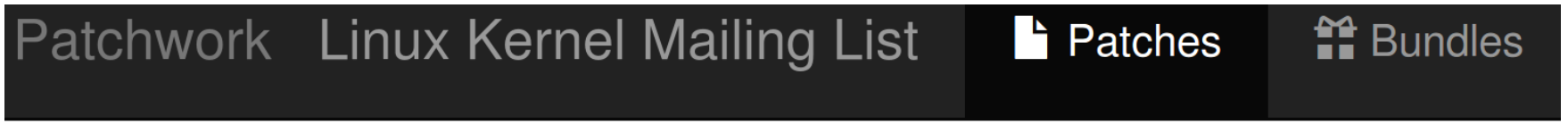
- Files changed: 939
- 1126 (interactions in general)

My experience with CoC



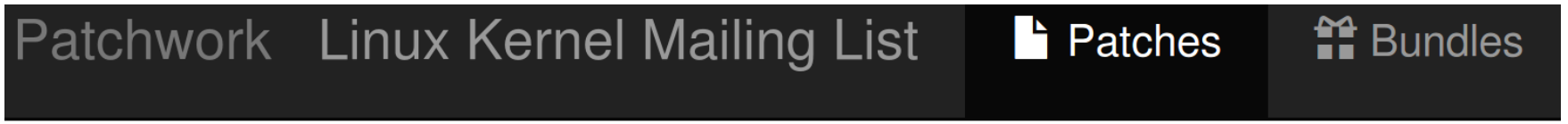
- Files changed: 939
- 1126 (interactions in general)
- 3 stand out

My experience with CoC



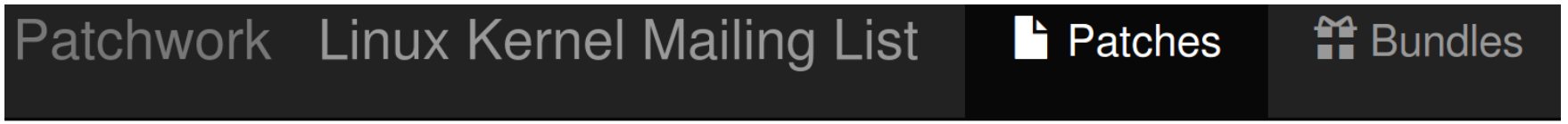
- Files changed: 939
- 1126 (interactions in general)
- 3 stand out
  - “This crap… !!”

My experience with CoC



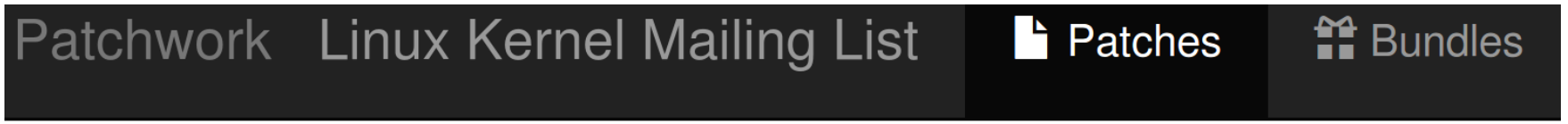
- Files changed: 939
- 1126 (interactions in general)
- 3 stand out
  - “This crap… !!”
  - “I hate when… !!”

My experience with CoC



- Files changed: 939
- 1126 (interactions in general)
- 3 stand out
  - “This crap… !!”
  - “I hate when… !!”
  - Deference

My experience with CoC



- Files changed: 939
- 1126 (interactions in general)
- 3 stand out
  - “This crap… !!”
  - “I hate when… !!”
  - Deference
- 0.27% (3 out of 1126)

99.73% of a pleasure :P

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Thank you!

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