Real-time Android

RTAndroid makes real-time Android possible. It provides support for applications with real-time requirements while preserving all benefits of Android. Extended system components augment the new platform with a predictable and deterministic real-time behavior on different levels. By creating a reliable execution environment for general purpose mobile devices, RTAndroid can be used as a low-cost platform for data monitoring and visualization or in the field of industrial automation and control.

The platform has been carefully designed based on many years of experience in Android and real-time systems to preserving the standard Android application programming model, as well as the full compatibility to already existing Android components and third-party software.

General Information

RTAndroid was developed by the Embedded Software Laboratory at RWTH Aachen University and provides a reliable execution environment for applications with real-time requirements on common mobile devices. The platform benefits from Android’s high usability and its wide range of supported hardware. The application framework and the original system API are extended with functionality that turn Android into a predictable and deterministic soft real-time system. Due to the fact that RTAndroid is fully backward compatibility to the original Android platform, application development is just as comfortable as for the stock Android platform. Android is built upon a Linux kernel, which has been modified in RTAndroid to allow deterministic priority-based process scheduling. Furthermore, RTAndroid introduces a number of additional features to ensure a reliable process execution:

- Predictable interprocess communication using Intent broadcasting
- Non-blocking, real-time capable garbage collection
- Extended system services for bypassing Android’s low memory process killer
- Isolation of the running real-time application on one of the available CPUs

The synergy of the described techniques allows predictable execution times and significantly reduced latencies.
Industrial Android with emteria.OS

A brand new industrial Android release for Raspberry Pi 3 and dedicated industrial hardware platforms was published under a new name emteria.OS. It has been developed from scratch based on the latest Android 7 release from Google and includes all recent bugfixes, additional features, simplified installation process and support for commercial applications. Test it for free at https://emteria.com and provide us your feedback in the new discussion forum.

Contact

Dr. Igor Kalkov ik@emteria.com

Publications

[Kal17]

A real-time capable, open-source-based platform for off-the-shelf embedded devices

Bibtex entry:

@phdthesis { Kal17,
  author = { Kalkov, Igor },
  othercontributors = { Kowalewski, Stefan and A{\ss}mann, Uwe },
  title = { A real-time capable, open-source-based platform for off-the-shelf embedded devices },
  publisher = { RWTH Aachen University, Department of Computer Science },
  school = { RWTH Aachen University },
  pages = { 1 Online-Ressource (xx, 114 Seiten) : Illustrationen, Diagramme },
  series = { Aachener Informatik-Berichte },
  year = { 2017 },
  address = { Aachen },
  doi = { 10.18154/RWTH-2018-222005 },
  typ = { PUB:(DE-HGF)3 },
  reportid = { RWTH-2018-222005 },
  cin = { 122810 / 120000 },
  url = { http://publications.rwth-aachen.de/record/719343/files/719343.pdf },
}

[KGK17]


Explicit priorityization of parallel Intent broadcasts in real-time Android

Bibtex entry:

@inproceedings { KGK17,
  author = { Kalkov, Igor and Gurghian, Alexandru and Kowalewski, Stefan },
  title = { Explicit prioritization of parallel Intent broadcasts in real-time Android },
  booktitle = { Concurrency and computation },
  publisher = { Wiley },
  volume = { 29 },
  number = { 22 },
  year = { 2017 },
  address = { Chichester },
  issn = { 1532-0626 },
  organization = { 12th International workshop on Java Technologies
}

**Priority Inheritance during Remote Procedure Calls in Real-Time Android using Extended Binder Framework**

Bibtex entry:

```bibtex
@inproceedings { KGK15,
    author = { Kalkov, Igor and Gurghian, Alexandru and Kowalewski, Stefan },
    title = { Priority Inheritance during Remote Procedure Calls in Real-Time Android using Extended Binder Framework },
    publisher = { ACM Press New York, New York, USA },
    pages = { 5, 10 Seiten },
    year = { 2015 },
    doi = { 10.1145/2822304.2822311 },
    typ = { PUB:(DE-HGF)8 },
    reportid = { RWTH-2016-03747 },
    cin = { 122810 / 120000 },
    url = { http://publications.rwth-aachen.de/record/573802 },
}
```

Echtzeiterweiterung für Android: SPS inside

Bibtex entry :

@article { KKO+15,
    author = { Kowalewski, Stefan and Kalkov, Igor and Obster, Mathias and Th{"o}nnessen, David },
    title = { Echtzeiterweiterung f"ur Android: SPS inside },
    journal = { IEE - Elektrische Automatisierung + Antriebstechnik },
    publisher = { IEE },
    pages = { 58-61 },
    year = { 2015 },
    issn = { 1434-2898 },
    typ = { PUB:(DE-HGF)16 },
    reportid = { RWTH-CONV-236305 },
    cin = { 122810 / 120000 },
    url = { http://publications.rwth-aachen.de/record/752275 },
}

[AFK+14]


An Approach for Using Mobile Devices In Industrial Safety-Critical Embedded Systems

Bibtex entry :

@inbook { AFK+14,
    author = { Armoush, Ashraf and Franke, Dominik and Kalkov, Igor and Kowalewski, Stefan },
    title = { An Approach for Using Mobile Devices In Industrial Safety-Critical Embedded Systems },
    publisher = { Springer },
    pages = { 294-297 },
    volume = { 130 },
    series = { Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering },
    year = { 2014 },
    address = { Cham },
    doi = { 10.1007/978-3-319-05452-0_27 },
    typ = { PUB:(DE-HGF)8 },
    reportid = { RWTH-CONV-203202 },
    cin = { 120000 / 122810 },
    url = { http://publications.rwth-aachen.de/record/225590 },
}
Predictable Broadcasting of Parallel Intents in Real-Time Android

Bibtex entry:

```bibtex
@inbook { KGK14,
    author = { Kalkov, Igor and Gurghian, Alexandru and Kowalewski, Stefan },
    title = { Predictable Broadcasting of Parallel Intents in Real-Time Android },
    publisher = { ACM },
    pages = { 57-66 },
    series = { ACM international conference proceedings series },
    year = { 2014 },
    address = { New York, New York },
    typ = { PUB:(DE-HGF)8 },
    reportid = { RWTH-CONV-205503 },
    cin = { 120000 / 122810 },
    url = { http://publications.embedded.rwth-aachen.de/file/5g },
}
```

Development and Execution of PLC Programs on Real-Time Capable Mobile Devices

Bibtex entry:

```bibtex
@inproceedings { OKK14,
    author = { Obster, M., Kowalewski, S., and Kalkov, I. },
    title = { Development and Execution of PLC Programs on Real-Time Capable Mobile Devices },
}
```
Non-Blocking Garbage Collection for Real-Time Android

Bibtex entry:

@inbook{GKS+13,
  author = {Gerlitz, Thomas and Kalkov, Igor and Schommer, John F. and Franke, Dominik and Kowalewski, Stefan },
  title = {Non-Blocking Garbage Collection for Real-Time Android },
  publisher = {ACM },
  pages = {108-117 },
  series = {ACM Digital Library },
  year = {2013 },
  address = {New York, NY },
  doi = {10.1145/2512989.2512999 },
  typ = {PUB:(DE-HGF)8 },
  reportid = {RWTH-CONV-202515 },
  cin = {120000 / 122810 },
  url = {http://publications.rwth-aachen.de/record/224782 },

A Real-time Extension to the Android Platform

Bibtex entry:

@inproceedings { KFS+12,
   author = { Kalkov, Igor and Franke, Dominik and Schommer, John F. and Kowalewski, Stefan },
   title = { A Real-time Extension to the Android Platform },
   booktitle = { JTRES 2012 : proceedings of the 10th International Workshop on Java Technologies for Real-time and Embedded Systems, October 24-26, 2012, Copenhagen, Denmark / Andy Wellings ... },
   publisher = { ACM Press },
   pages = { 105-114 },
   series = { ACM conference proceedings series },
   year = { 2012 },
   address = { New York, N.Y. },
   doi = { 10.1145/2388936.2388955 },
   typ = { PUB:(DE-HGF)8 },
   reportid = { RWTH-CONV-199219 },
   cin = { 120000 / 122810 },
   url = { http://publications.rwth-aachen.de/record/129215 },
}