

# 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.

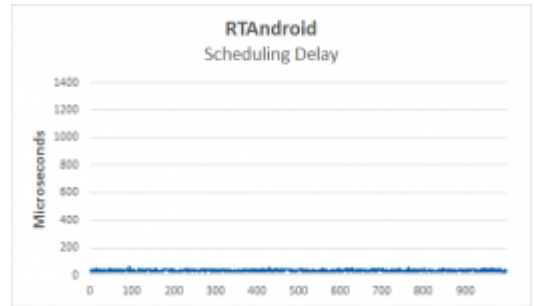
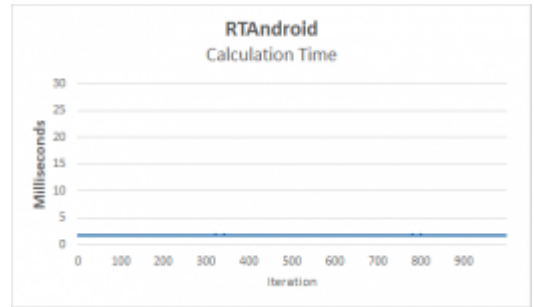
The platform has been carefully designed based on many years of experience in Android and real-time systems to preserving the standard Android application programming model, as well as the full compatibility to already existing Android components and third-party software.

## 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 compatible 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](mailto:ik@emteria.com)

## Publications

[Kal17]

[PDFBIB](#)

Kalkov, I., "A real-time capable, open-source-based platform for off-the-shelf embedded devices", PhD Thesis, Aachen, 2017.

# 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 },
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  http://publications.rwth-aachen.de/record/719343/files/719343.pdf },
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[KGK17]

[PDFBIB](#)

Kalkov, I., Gurchian, A., and Kowalewski, S., "Explicit prioritization of parallel Intent broadcasts in real-time Android", in *Proc. Concurrency and computation*, Chichester, 2017, vol. 29, Wiley.

# Explicit prioritization of parallel Intent broadcasts in real-time Android

## Bibtex entry :

```
@inproceedings { KGK17,
  author = { Kalkov, Igor and Gurchian, Alexandru and Kowalewski,
  Stefan },
  title = { Explicit prioritization of parallel Intent broadcasts in
  real-time Android },
  booktitle = { Concurrency and computation },
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for
    Real-Time and Embedded systems, Niagara Falls, NY (USA),
    2014-10-13 - 2014-10-14 },
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[KGK15]

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### Bibtex entry :

```
@inproceedings { KGK15,
    author = { Kalkov, Igor and Gurchian, Alexandru and Kowalewski,
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    title = { Priority Inheritance during Remote Procedure Calls in
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    booktitle = { Proceedings of the 13th International Workshop on
Java
Technologies for Real-time and Embedded Systems },
    publisher = { ACM },
    pages = { 5, 10 Seiten },
    series = { ACM Other conferences },
    year = { 2015 },
    address = { New York, NY },
    organization = { 13. International Workshop on Java Technologies
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2015-10-08 },
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[KKO+15]

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  author = { Kowalewski, Stefan and Kalkov, Igor and Obster, Mathias
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  Th{"o}nnessen, David },
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  journal = { IEE - Elektrische Automatisierung + Antriebstechnik },
  publisher = { IEE },
  pages = { 58-61 },
  year = { 2015 },
  issn = { 1434-2898 },
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  cin = { 122810 / 120000 },
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[AFK+14]

[PDFBIB](#)

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  author = { Armoush, Ashraf and Franke, Dominik and Kalkov, Igor and
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  title = { An Approach for Using Mobile Devices In Industrial
Safety-Critical Embedded Systems },
  booktitle = { Mobile Computing, Applications, and Services : 5th
International Conference, MobiCase 2013, Paris, France,
November 7-8, 2013, Revised Selected Papers },
  publisher = { Springer },
  pages = { 294-297 },
  series = { Lecture Notes of the Institute for Computer Sciences,
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[KGK14]

[PDFBIB](#)

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  author = { Kalkov, Igor and Gurchian, Alexandru and Kowalewski,
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  title = { Predictable Broadcasting of Parallel Intents in Real-Time
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  pages = { 57-66 },
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[OKK14]

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*Electronics Society*, Piscataway, NJ, 2014, IEEE, p. 8.

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  author = { Obster, Mathias and Kalkov, Igor and Kowalewski, Stefan
},
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  Capable Mobile Devices },
  booktitle = { 2014 IEEE [International Conference on] Emerging
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  pages = { 8 Seiten },
  year = { 2014 },
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  2014-09-16 - 2014-09-19 },
  doi = { 10.1109/ETFA.2014.7005218 },
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  reportid = { RWTH-CONV-206433 },
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  author = { Gerlitz, Thomas and Kalkov, Igor and Schommer, John F.
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  Franke, Dominik and Kowalewski, Stefan },
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  booktitle = { 11th International Workshop on Java Technologies for
  Real-time and Embedded Systems : JTRES 2013 ; 9-10 October
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    Systeme, Karlsruhe (Germany), 2013-10-09 - 2013-10-10 },
doi = { 10.1145/2512989.2512999 },
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url = { http://publications.rwth-aachen.de/record/224782 },
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[KFS+12]

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    on Java Technologies for Real-time and Embedded Systems,
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  publisher = { ACM Press },
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  series = { ACM conference proceedings series },
  year = { 2012 },
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