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EMBEDDING TECHNOLOGY

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Display ARM-based, HMI, Qt / Android per applicazioni industriali

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Applicazioni industriali e real-time su dispositivi eterogenei multi/many-core

T3Lab, Bologna, 18/10/2017

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The company

Founded in 2002 as spin-off company of the
Real-Time Systems Lab at Scuola Superiore S.Anna

- ~22 qualified people with an average age of 38 years
- 15+ years of experience in academic and industrial projects
  - One third of the company has a PhD degree

Our Mission:
We design and develop great software for small electronic devices

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products and services

RTOS , Firmware, Embedded Linux

- AUTOSAR, OSEK/VDX, device drivers
- Embedded Linux: 12 Yrs experience BSPs, GCC, U-Boot, Kernel drivers
- Initial developers of the SCHED_DEADLINE patch
- Hypervisors, Android, Ubuntu Core, QEMU and emulators

Application Development

Model-based design

- Matlab/Simulink/Stateflow
- National Instruments LabView
- E4Coder toolset for code generation
- UML/SYSML/Ecore/ Eclipse/Acceleo

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HMI on Linux

Why choosing Linux for an HMI?

- (typically) No royalties
- Support for peripherals/filesystem/bluetooth/USB/Wifi
- Support for scripting languages / C-C++ / existing libraries-applications
- Support for mainstream distributions
- Mix of Real-Time and HMI

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Classification

Small systems (< 400 Mhz)

- Qt on Framebuffer

Medium systems (400-900 MHz)

- Qt on Framebuffer or Xserver
- OpenGL on Framebuffer

Bigger systems (>800 MHz)

- Android
- Qt on Framebuffer or Xserver

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Footprint and boot time

Footprint

- Minimal systems
  - Qt around 50 Mb → need for 64Mb Flash / 64Mb RAM
- Ubuntu/Android
  - Almost a complete distribution… → >1Gb Flash, >1Gb RAM

Boot times

- iMX6 with OpenGL applications → < 1 sec
- iMX6 with Qt Applications → < 4sec (see demo!)
- iMX6 with Ubuntu → 30 sec (typical)
- Android → several seconds

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Open-source alternatives for HMI

What are the alternatives to consider for an HMI library?

- Qt - https://www.qt.io/

- Android - https://www.android.com/

- Other libraries
  (OpenGL, WxWidgets, GTK, PEG, emWin, Enlightment)

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Licensing

You need to take care about licensing when deploying your linux HMI system

- Qt → LGPLv2 until 5.3
  GPLv3/LGPLv3 after 5.7, or commercial
- Android → mostly BSD-like

- GTK → LGPL v2
- Enlightment → BSD

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Qt Libraries

- Evidence develops Qt Applications for industrial and embedded applications

Evidence used Qt in various projects, including:

- development of HMI for embedded touchscreen powered by Embedded Linux
- development of graphical applications on multicore i386 machines (simulator of aviation control tower)
- development of customized widgets for specific applications

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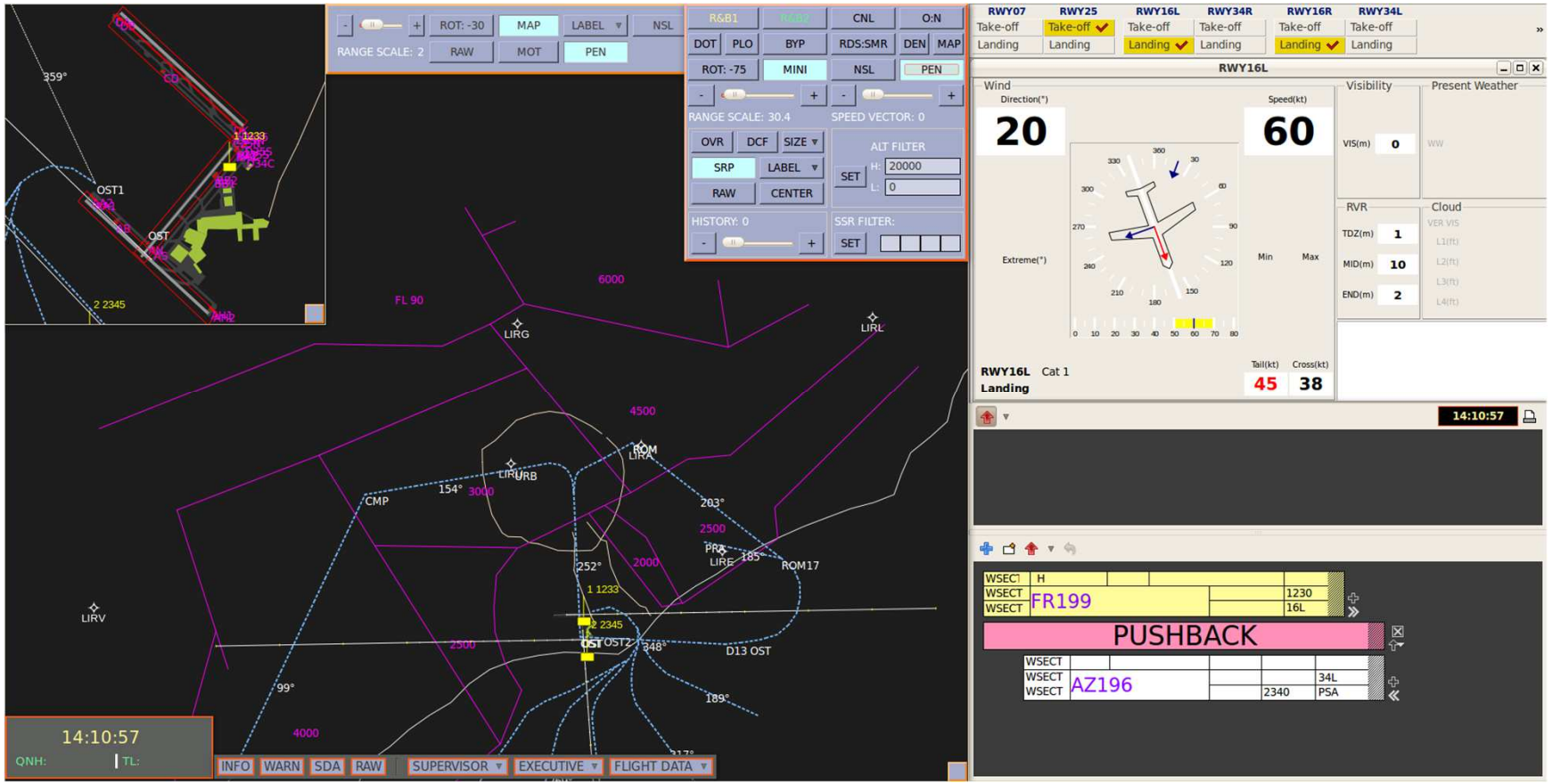
Cockpit for ENAV controllers



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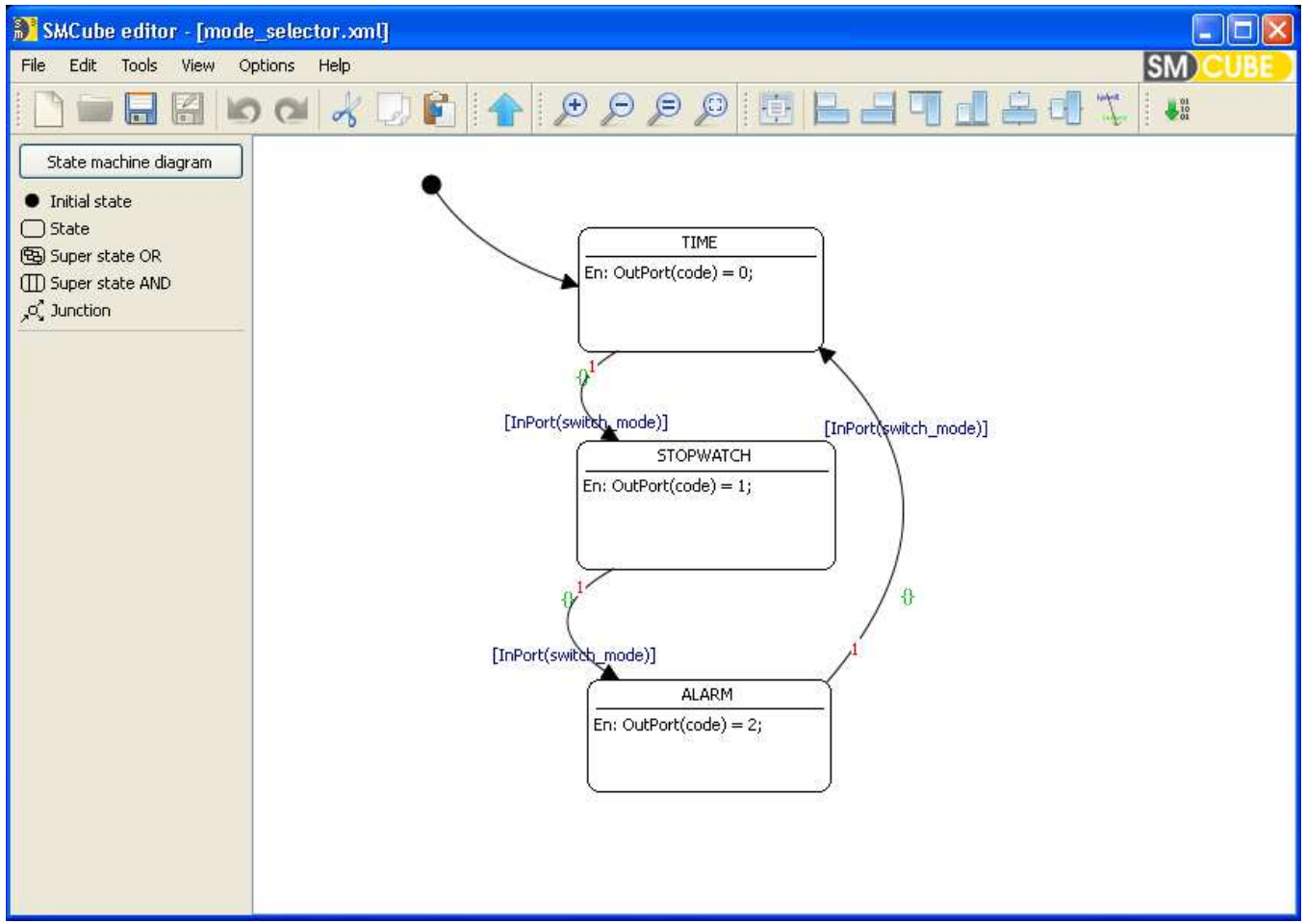
State machine simulator



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Industrial Qt Application

- HMI developed in Qt
- for touch screens with custom widgets
- smooth transitions between different pages

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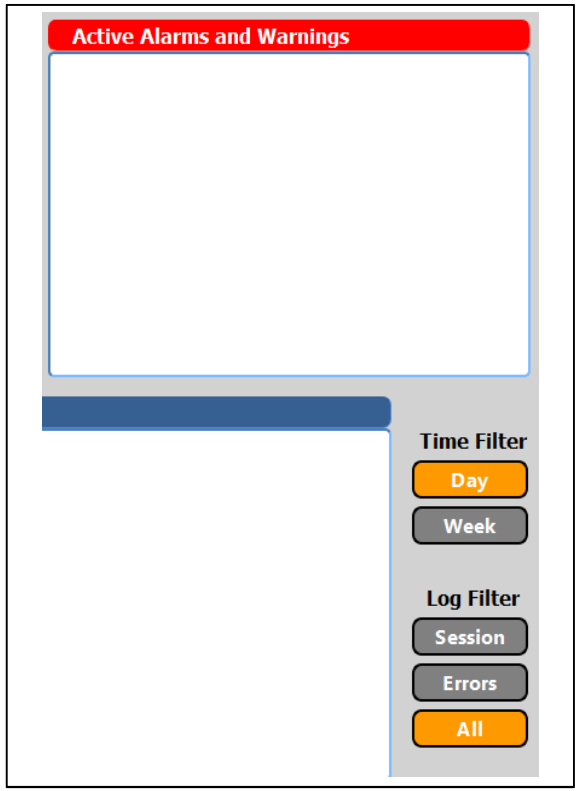
Industrial Qt Application (2)

The HMI was developed in Qt (version 4.x).

All widgets were completed redesigned in order to have a common, custom flavor



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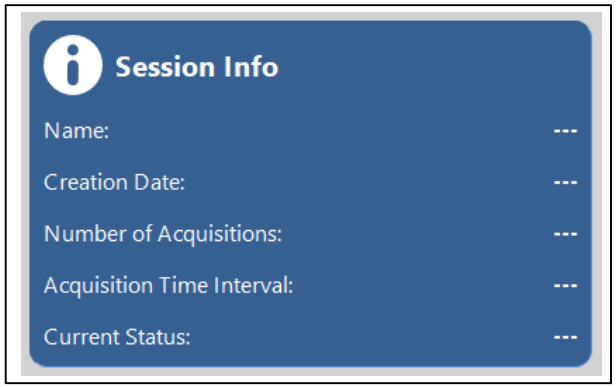
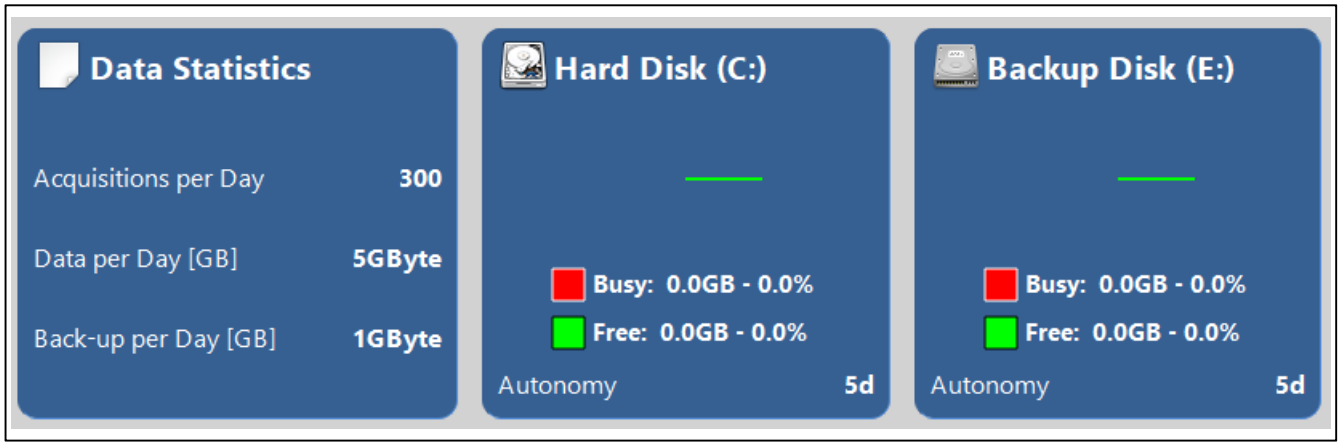
Industrial Qt Application (3)

The HMI was developed to be intuitive.

Needed data can be collected at a glance





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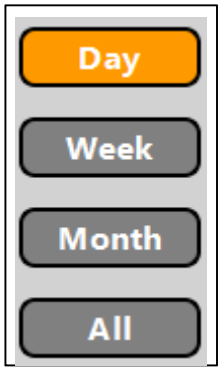
Industrial Qt Application (3)

The HMI was designed to be used as a «normal» desktop application or as a mobile app.

Smooth transition between pages can be achieved by pressing buttons or by using swiping gestures.



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Video/Demo app Qt

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Android for industrial applications

Born for mobile phones… but used also in industrial applications

Main reasons to use Android in industrial applications

- Handling of general purpose peripherals
- Java programs usable also on Phones and Tablets
- Advanced graphical effects, multi-touch, …
- Availability of developers

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How to run your custom Android

You need to take care of at least the following:

- HW support (in the Linux kernel, and then in Android)
- Dashboard customization
- Limit the base functionalities
- Custom App-Store

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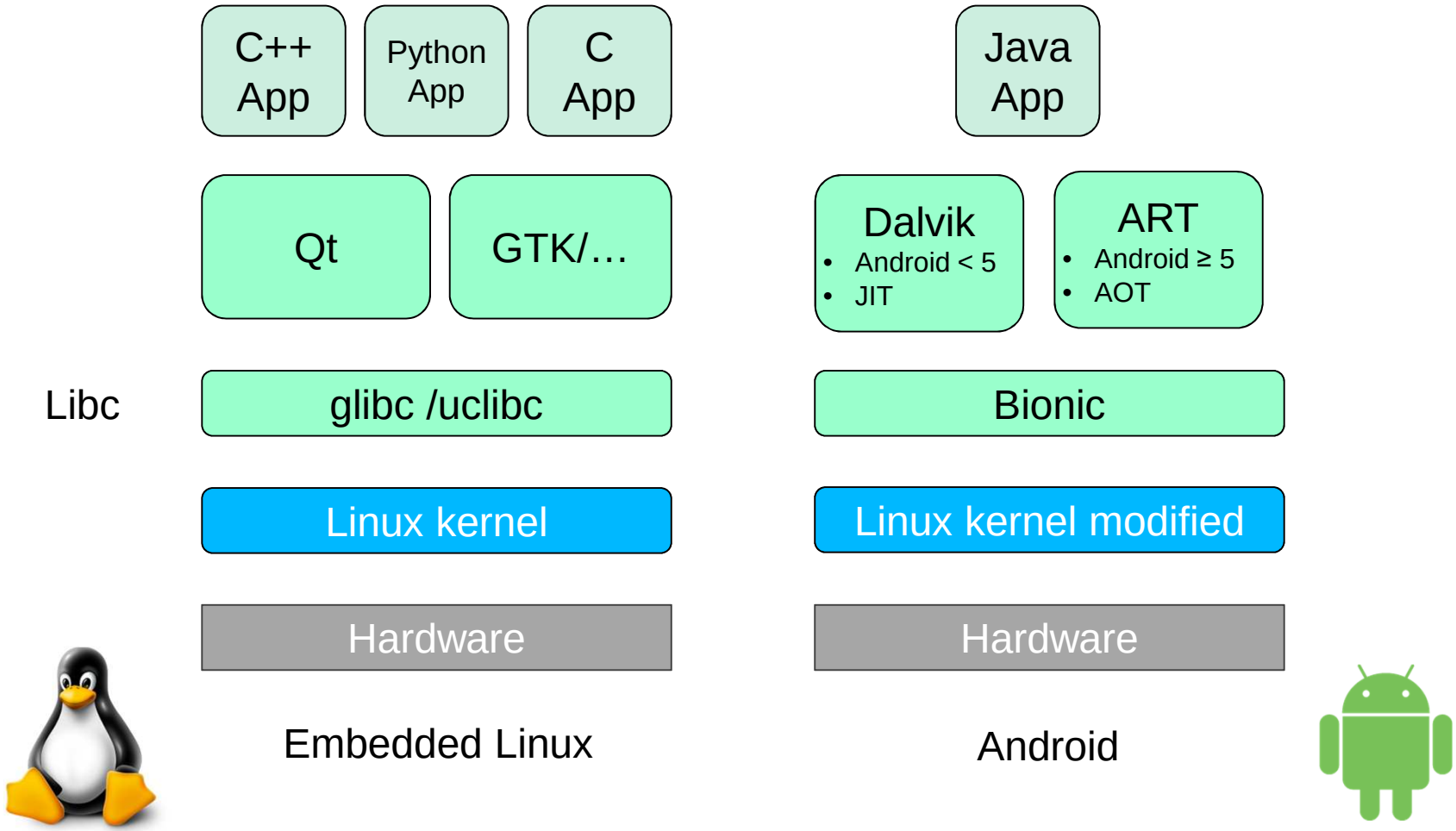
Embedded Linux vs Android



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Embedded Linux vs Android

	Embedded Linux	Android
Linux kernel maintainer	Community/ SoC manufacturer	Google
Industry-friendly licensing		
Ease of application development		
Performance		
Real-time		
Number of platforms supported		
Custom setups and services		

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