Real-time OS solution for various platforms in Connected Cars, AI, and IoT
About eSOL

Basic Information

Founded: May 1975 (Founded as ERG Co., Ltd.)
Capital: US$2.4 million (Apr 2017)
President: Katsutoshi Hasegawa
Revenues: US$67 million (Fiscal year 2017)
Employees: 388
Head Offices: Tokyo, Japan

Key Customers


History

1975: Established ERG Co., Ltd. on May 29
1999: Released the PrKERNELv4 real-time OS
2001: Rename ERG Co., Ltd. to eSOL Co., Ltd. Released the eBinder IDE
2005: Released the eT-Kernel real-time OS
2006: Released the eT-Kernel Multi-Core Edition real-time OS
2008: Released the eT-Kernel Multi-Core Edition Memory Partitioning
2009: Investment by ARM Ltd. in eSOL
2011: Released eSOL Geminus series handy terminals
2012: Published eT-Kernel Temporal Partitioning
2014: Developed real-time operating system for many-core processors "eMCOS"
2015: Established new subsidiary eSOL TRINITY Co., Ltd
2016: Established AUBASS Co., LTD in joint venture
2018: Established "eSOL Europe" subsidiary in France
Automotive Strategy

- Scalable/High Reliability RTOS & IDE
- Functional Safety (ISO 26262) Certification
- Engineering Service
- Academic and Industrial activity
  - AUTOSAR Premium Member
  - Embedded Multicore Consortium
  - Multicore Association SHIM Working Group
  - Internet ITS Consortium, Urban Drive working group

- BSW Development & Selling License
- Tool Development & Selling License
- BSW Engineering Service

- Functional Safety (ISO 26262) Tools & Consultation Services
- Process Management Tools
- Model-Based Development (MBD) Tools & Services
- Static Analysis Tools
- Virtual Platform and Simulator
- Training
eSOL strong relationship with Arm

• **Arm Training Partner**
  eSOL key focus is to support Arm architecture, and we provide Arm architecture training program for embedded software engineers.

• **eSOL IDE with Arm Compiler 6**
  Our latest IDE tool is bundled with Arm compiler 6. We are also promote Arm complier for AUTOSAR Adaptive platform.

• **Binder is integrated with Arm Fast Models**
  Arm Fast Models Support software development using eSOL's RTOS platform and skills related to Arm architecture.

• **Awarded distributor**
  eSOL is awarded “Most Forward Thinking Distributor in Asia 2017”
Real-time OS solution for various platforms in Connected Cars, AI, and IoT
A Connected Car is...

Driver assistance for safe driving

Vehicle Maintenance Management

Commercial Vehicle Operation Management

Emergency call

Infotainment

ADAS

AND MORE NEW SERVICES...
Connected Car Market is growing rapidly

Source: IHS Markit Technology
Higher and higher service level requested

Amount of Automotive related data in total data exchanged

From simple connection application to Cloud based rich Services.

Source: IHS Markit Technology
Connected Car Platform must be...

1. Must **CONNECT TIGHTLY** and **ISOLATE FIRMLY** functionalities each other

2. Must be **SAFE**

3. Must be **EASILY ADAPTED** to cutting edge technologies.

4. Must utilize **CLOUD** services with “Best effort” basis.
MCOS  Multi-core and Many-core Technology

The world leading advanced multi-manycore technology with eSOL’s OS expertise

• **Scalable multi/many-core RTOS**, from single-core to hundreds of cores

• **Distributed microkernel architecture** allows seamless integration of heterogeneous and multi-chip systems

• **Patented scheduling algorithm** achieves both real-time capability and **throughput**

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**Embedded Multicore Consortium (Japan)**
Vice President

The Multicore Association SHIM
Working Group Chair

✓ IEEE Coolchips TPC
✓ Urban Drive Working Group
✓ Waseda Advanced Multi-processing Lab Research fellow
✓ JEITA Microprocessor committee
✓ NEDO Technical Committee
eMCOS - an ideal RTOS platform for connected cars

eMCOS - Consists of distributed microkernel - easily realizes seamless but still safe collaborative system over various kinds of software/hardware.

- Functional safety
- Easy adaptation to various cutting edge software framework, middleware
- From micro computer to multi – many cores, and multi chip are supported
- Seamless communication between cores and CPUs
- Safety & Security by isolation
1. Must **CONNECT TIGHTLY** and **ISOLATE FIRMLY** functionalities each other
Hard real-time is guaranteed with noninterference multiprocessing where each core is completely independent and unaffected by other cores. Must CONNECT TIGHTLY and ISOLATE FIRMLY functionalities each other.

- Non-interference multiprocessing
- Low jitter
- No Big lock
- Fast Response Speed
- No effects from OSS, Linux
2. Must be **SAFE**

eSOL has obtained ISO 26262 ASIL D, the highest level for **Functional Safety** upon eT-Kernel. eMCOS is also planned to acquire certification.
3. Must be EASILY ADAPTED to cutting edge technologies.

Various frameworks can be imported to eMCOS environment.

Classic Platform

Adaptive Platform

AWS

AUTOSAR

ROS

SDSoC

reVISION

eMCOS

POCO

NGINX

boost

mbed

gstreamer
3. Must be EASILY ADAPTED to cutting edge technologies.

http://monoist.atmarkit.co.jp/mn/articles/1801/17/news104.html

- Adaptive AUTOSAR

AUBIST Adaptive OS POSIX

- POSIX based OS suitable for Adaptive PF
- OS technology that supports in-vehicle distributed system

- Distributed microkernel architecture
  - Message passing including inter-core communication
  - Core Local Scheduling
  - Group multiple cores as clusters

Provide a mechanism for distributed management of various OS resources, services and applications.
4. Must utilize **CLOUD** services with “Best effort” basis.

Robust, secure and reliable system through Amazon FreeRTOS

Extend embedded system with the latest rich Web APIs, in return creates an easy-to-use embedded platform for Web engineers

In AWS Greengrass, devices continue to communicate on local network and exchange message even if internet is disconnected.
Already started

ADAS car drive demonstration in Aichi ITS world 2015 / the 19th Nagoya Motor show

The realtime control part of ADAS software “Autoware”\(^{(1)}\) had been implemented on eMCOS, that was shown in ADAS car drive demonstration.

\(^{(1)}\) Autoware is developed by Nagoya Univ., Nagasaki Univ., and AIST.

ROS (Robot Operating System) environment had build on eMCOS and Linux. Autoware functions are implemented as ROS node.
eMCOS Application Example

NDT Matching Localization
Can be adapted to other applications - Ex. Distributed FA system with ROS

- In combination with ROS/ROS2 which are for distributed systems, distributed FA system can be implemented.
- With using ROS2 DDS, distributed systems with including Linux, OS less other RTOS systems can be implemented.
Conclusion

• eSOL provides cutting edge Embedded RTOS Platform which is ideal for safety critical and high demanding systems like Connected Car.

• eSOL RTOS platform can be adapted to wide range of application including high reliability systems like Automotive systems, Factory Automation, Medical applications and so on.
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