

# **μITRON OS and Java**

## **The Networked Appliance Solution**

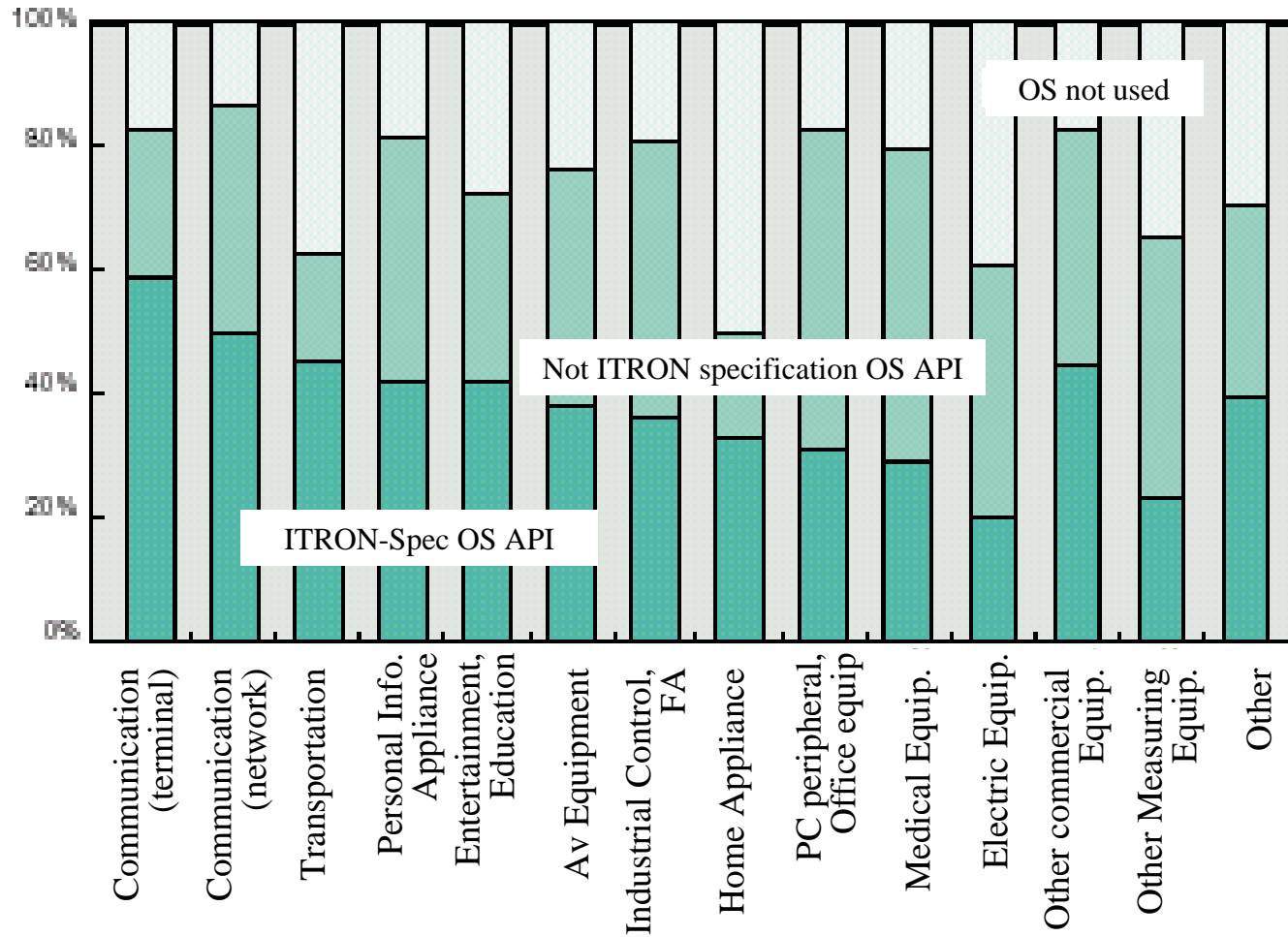
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**Electronic Devices Group  
FUJITSU LIMITED**



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# RTOS use in Embedded Systems in Japan

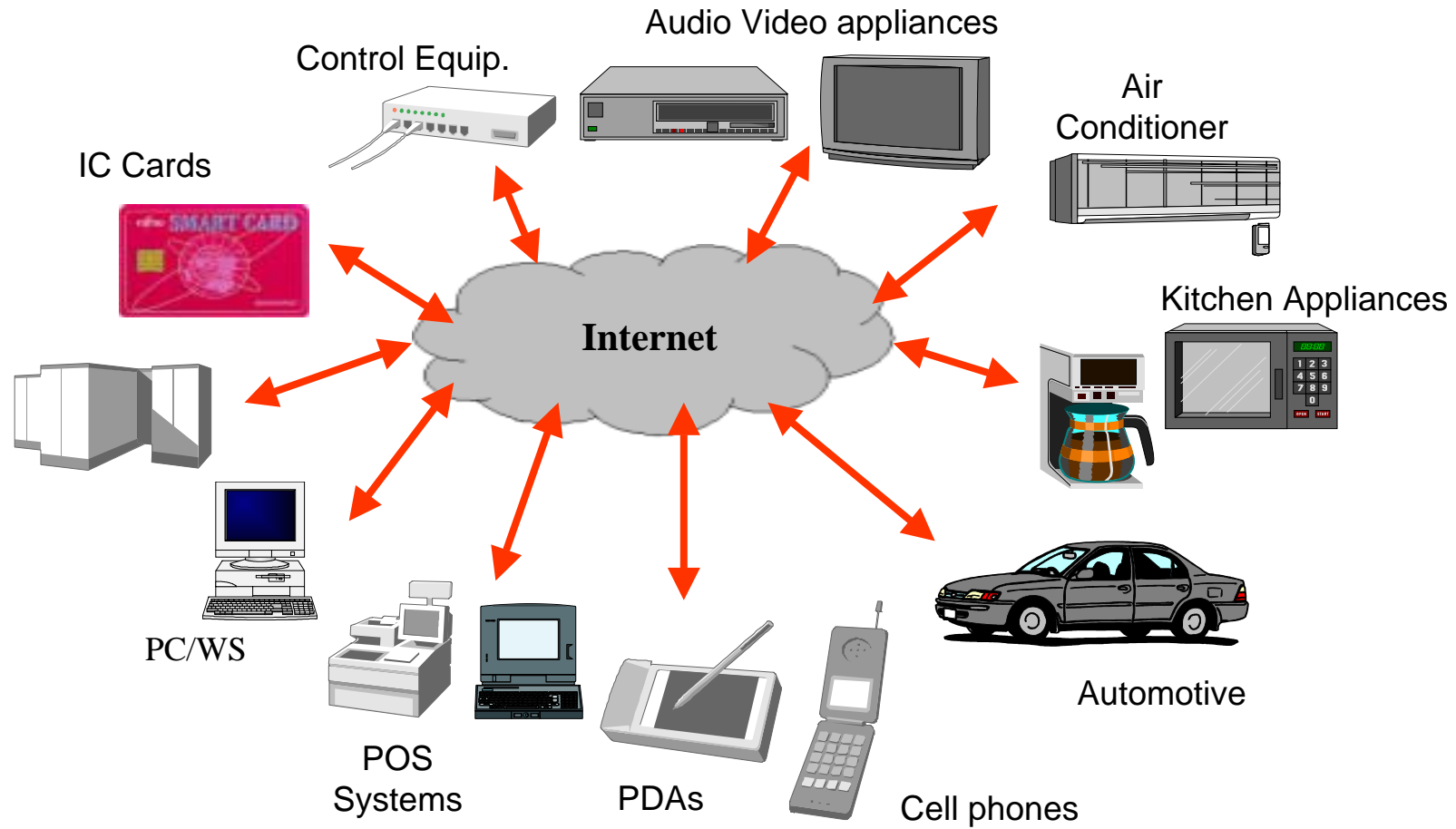


(ITRON Association Nov. 2000)



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# Ubiquitous Connectivity



**Java Connects**

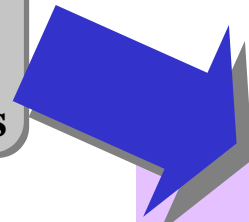


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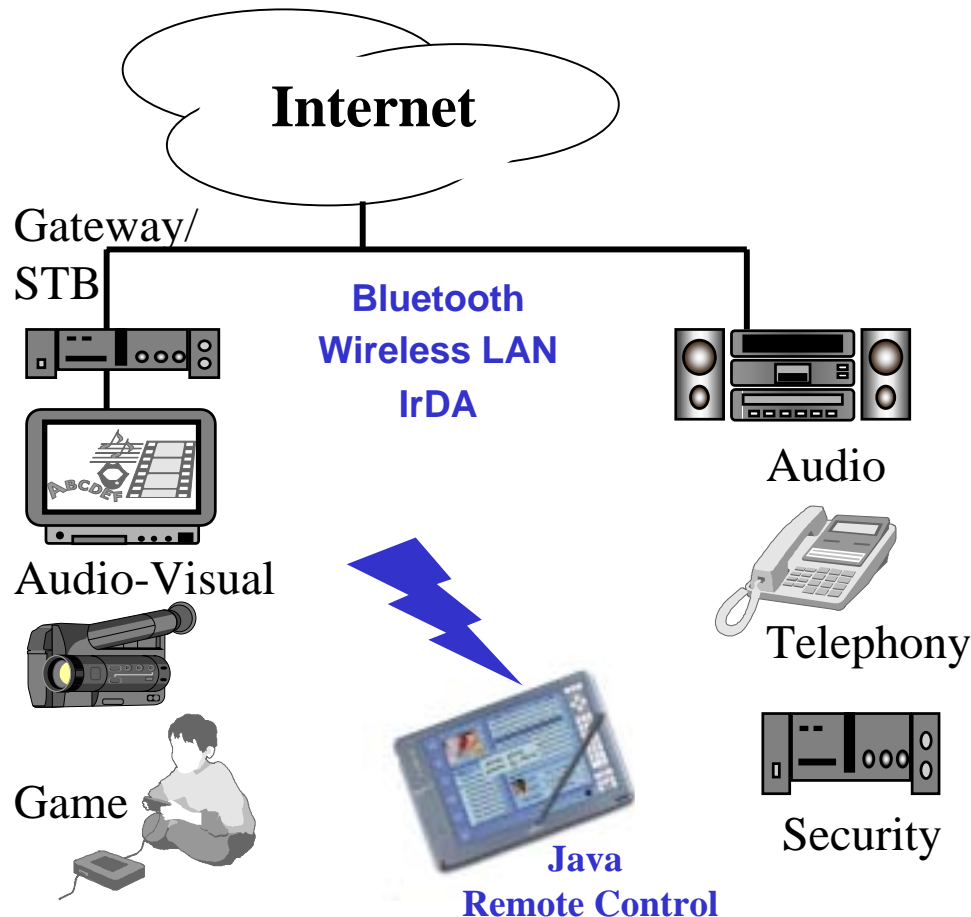
# The Networked Home

## The New Value Proposition of Home Appliances

**Home Networked Appliances = Hardware + Value Added Services**



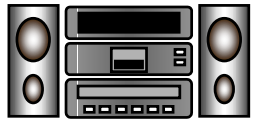
### Java is Key



- Run multiple applications with limited resources.
- Download what you want, when you want, where you want.
- Version / Functionality Updates.
- Network Connectivity.
- Customization.
- Personalization.
- Shortens Development Time

# The Networked Appliance Solution

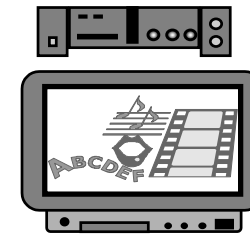
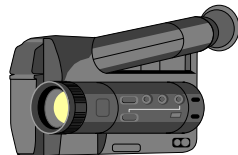
The ITRON OS is dominant in Japan's consumer electronics.  
From audio-visual products to home appliances to all the cellular phones in Japan (i-mode etc.)



Now for connectivity, Java is spreading to all devices including consumer devices, mobile devices etc.



**So, JTRON (Java API + ITRON OS) is spreading.**

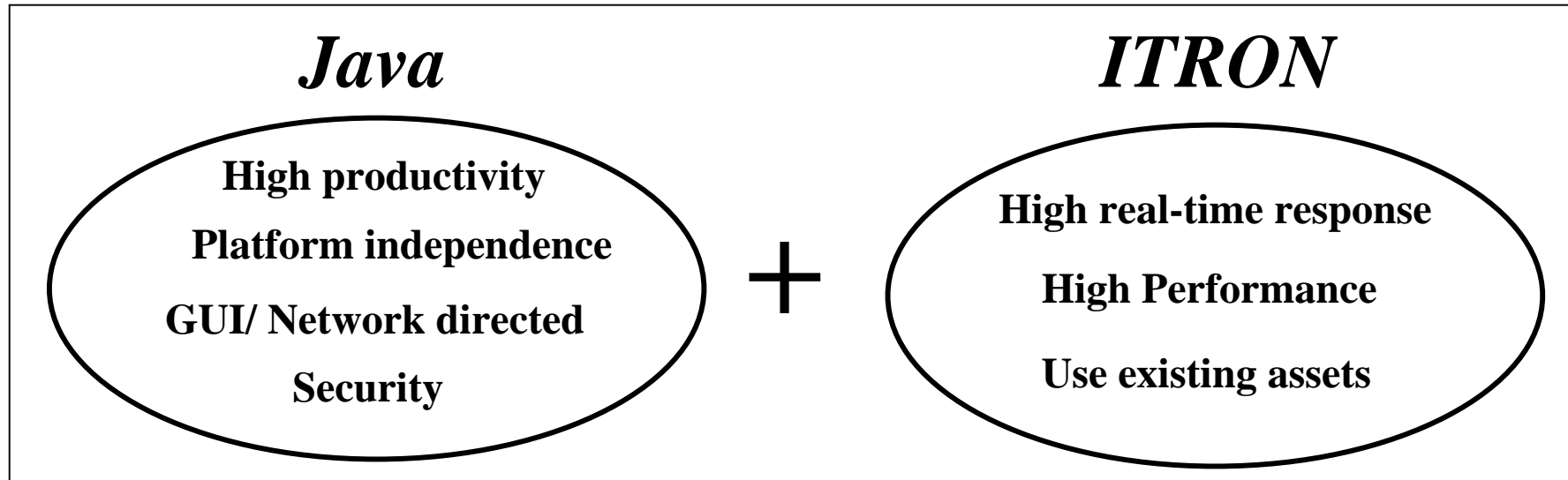


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# What is JTRON ?

- What is JTRON?



- Example:

## Java Program

```
class MotorGUI {  
    public void motorStat() {  
        <state display process>  
    }  
    public void motorRemote() {  
        <receive remote control >  
    }  
}
```

Synchronous comm.  
Task control  
Memory operation

## ITRON C Program

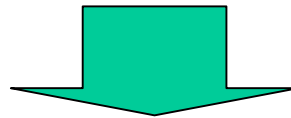
```
#include <itrondf.h>  
TASK motorControl()  
{  
    < Interrupt processing >  
    < hardware control >  
}
```



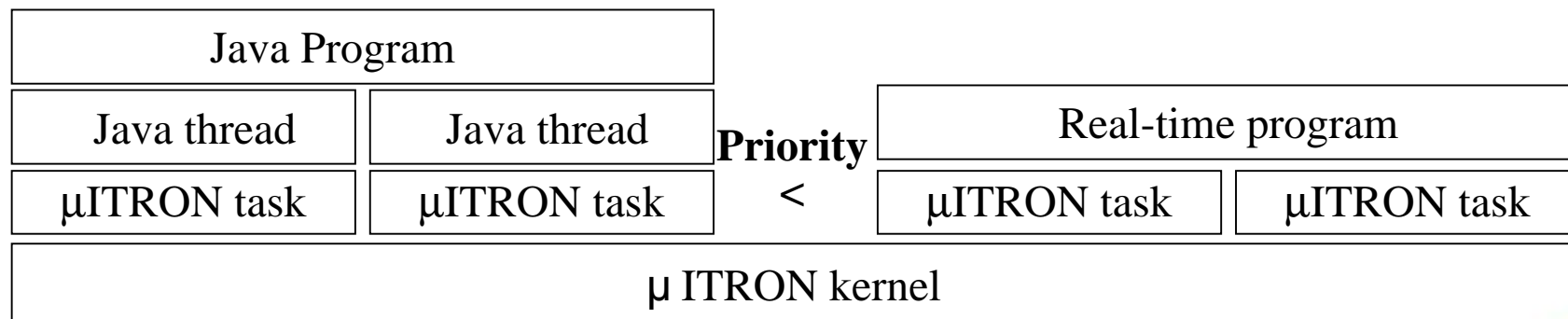
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# Real-time with JTRON

In JTRON, a Java thread runs as a  $\mu$ ITRON task managed by the  $\mu$ ITRON kernel.



A  $\mu$ ITRON task with a higher priority than a Java thread will not be disturbed by a non real-time Java thread.



# Components Available for Use (1)

## *JTRON solution on Java chip*

### • Kernel OS ( $\mu$ ITRON) “REALOS”

(Functions) Task admin., variable/fixed length memory, interrupt admin., synchronous communications (semaphore, event flag, mailbox), time admin

### • Sample device driver (on REALOS)

<b>Graphics</b>	<b>VGA / SVGA / XGA(CRT), VGA(NTSC)</b>
<b>Keyboard</b>	<b>PC101(English)/106(Japanese)keyboard, PS2 interface</b>
<b>Mouse</b>	<b>PS2 mouse</b>
<b>Ethernet</b>	<b>10/100BaseT</b>
<b>Serial port</b>	<b>TTY(console), modem</b>
<b>Flash</b>	<b>Flash file system driver (SoFFS)</b>
<b>IrDA</b>	<b>IrCOMM</b>
<b>Audio</b>	<b>AU, WAV format (output only)</b>
<b>PCMCIA</b>	<b>ATA PC card driver</b>
<b>Others</b>	<b>GPIO (LED),Real Time Clock, PCI, USB Bluetooth (RF-COMM)</b>





## Components Available for Use (2)

### • Libraries (on REALOS)

<b>Graphics library</b>	<b>Line, image, arc, oval, polygon, color manipulation, input event handling, text, font, cursor etc.</b>
<b>File System</b>	<b>Flash file system (SoFFS format), ATA PC card file system (FAT=DOS compatible) RAM file system</b>

### • Protocol Stack(Network) *“eTCP/IP”*

**Network library conforming to ITRON TCP/IP API spec.**

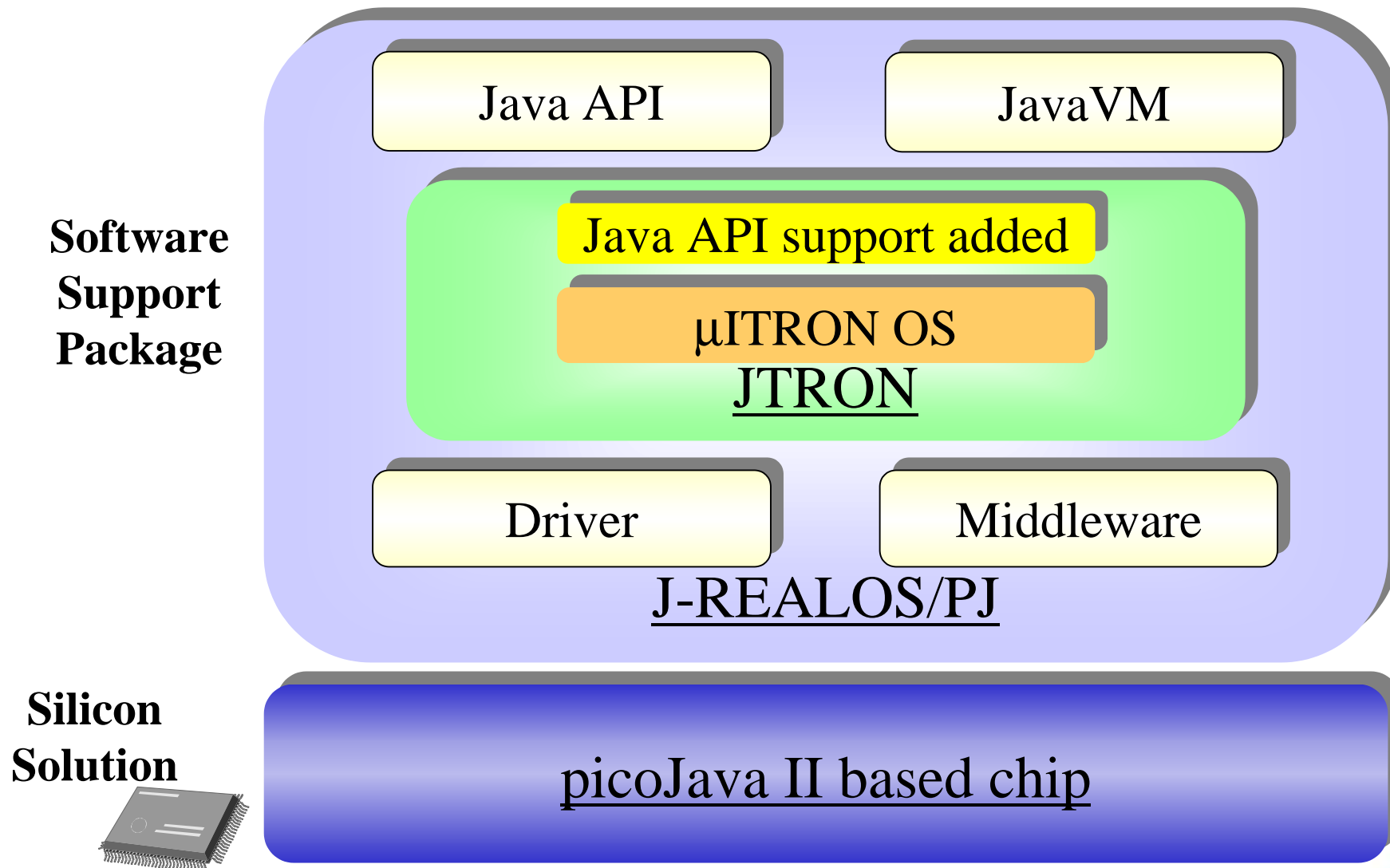
**Small memory, high performance (high speed, real-time response)**

<b>Data link layer</b>	<b>Ethernet, PPP(dialup)</b>
<b>Network layer</b>	<b>IP, ICMP, ARP, RARP, IGMP(multicast)</b>
<b>Transport layer</b>	<b>TCP, UDP</b>
<b>Application layer</b>	<b>DNS client</b>
<b>API</b>	<b>ITRON TCP/IP API, BSD socket interface</b>

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# picoJava™ -II Chip/ JTRON Solution



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# Boards Using the picoJava-II™ Based LSI



J-StarterKit  
for the picoJava™-II Architecture  
(Fujitsu Ltd.)



Trial production board for net appliance based on  
the PersonalJava™/picoJava™-II  
(Fujitsu Ltd.)



Prototype board for vending machines,  
based on picoJava™-II LSI  
(Fuji Electric Co., Ltd.)



Development Kit for picoJava™-II  
offered by Unicom automation Co.,Ltd.



picoJava™-II Reference board  
(NEW OS (GFPJ-II))  
offered by GAI0 Technology Co. Ltd.



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