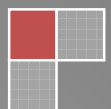




# MBS-SAM9G15/9G25 /9G35/9X25/9X35

## Linux User Manual V1.0

Release Date: 2012.4.30



Revision History

Rev	Date	Description	By
1.0	2012-4-30	Initial version	Heyong,Huangyin

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## Description

This document is divided into four parts. The first part describes how to start the Linux image quickly; the second part allows you to experience the Linux and describes the Linux system functional modules; the third part describes how to make a Linux system package, including building the environment, cross-compilation tools and source code compilation, and then downloading the Linux system to the board; the fourth part is the list of Linux software resources.

This document is for junior developers with experience of Linux-like operating systems (Ubuntu, Redhat, etc.), and developers with embedded systems development experience to the secondary development based on the system.

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# Chapter 1 Quick Start

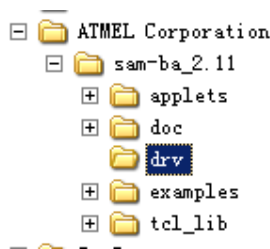
## 1.1 Preparation

(1) Install SAM-BA(vision 2.11 or more, location: 04-tools)

Note: If SAM-BA 2.10 or less is installed, we should uninstall it before installation.**(uninstall both SAM-BA software and board USB driver)**

(2) Power on, connect the board(J10) and PC using micro USB cable.

(3) Switch off the SW(1, 2) on the core board, and then reboot the board(Sequential can not be reversed). Driver will be prompted to install at the first time, the installation file is located:

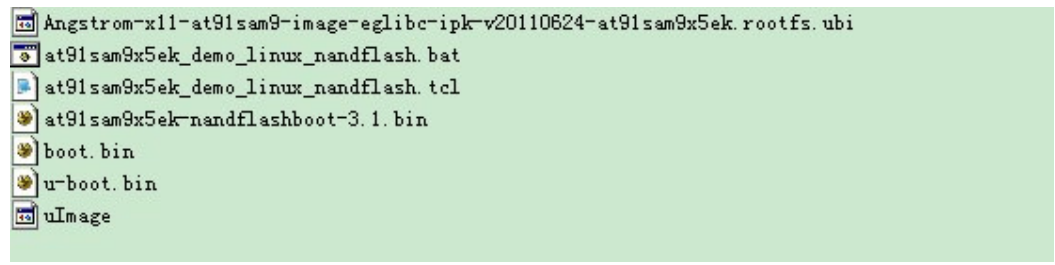


(4) When the driver is installed, it should be like this in the device manager:

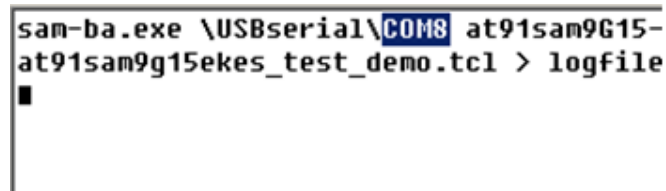


## 1.2 Download the Linux image automatically

Open the Linux package Linux\_4.3,as below:



Edit the file “at91sam9x5ek\_demo\_linux\_nandflash.bat” as below. Change the COMx to your AT91 USB to Serial Converter COM. Here we change it to COM8.



Switch on the SW-1, double click the download.bat([MS-DOS batch file, automatic download tool](#))

The Linux image will be downloaded to the board automatically. It will take 2 or 3 minutes.

## Chapter 2 Linux Function Test

We can operate the Linux after it runs through the touch screen. Here we operate it using hyper-terminal with serial port for convenience. Here we demonstrate how to use the Linux, such as mount U-disk and SD card, test Ethernet port, play music etc.

### 2.1 Touch-screen calibration

1) Open the hyper-terminal (bond-rate: 115200, data bits: 8, parity: none, stop bit: 1, data flow control: none). Start the Linux system. In order to calibrate the touch screen, we need to obtain the root privilege. Enter the command as below:

```
at91sam9x5ek login: root
root@at91sam9x5ek:~# ts_calibrate
```

It will show 5 points on the LCD screen in turn, press the points to calibrate the screen. If the calibration passed, it will take effect after reboot the system.

### 2.2 The use of U-disk

1) Enter the Linux via hyper-terminal, insert the U-disk into the USB host port, the hyper-terminal will show the information as below:

```
usb 2-3: new full speed USB device number 2 using at91_ohci
usb 2-3: not running at top speed; connect to a high speed hub
scsi0 : usb-storage 2-3:1.0
scsi 0:0:0:0: Direct-Access          USB FLASH DRIVE  PMAP PQ: 0 ANSI: 0 CCS
sd 0:0:0:0: [sda] 7831552 512-byte logical blocks: (4.00 GB/3.73 GiB)
sd 0:0:0:0: [sda] Write Protect is off
sd 0:0:0:0: [sda] Assuming drive cache: write through
sd 0:0:0:0: [sda] Assuming drive cache: write through
sda: detected capacity change from 0 to 4009754624
sda: sda1
sd 0:0:0:0: [sda] Assuming drive cache: write through
sd 0:0:0:0: [sda] Attached SCSI removable disk
```

2) The system mount the u-disk automatically, enter the U-disk using the commands as below:

```
root@at91sam9x5ek:~# cd /
root@at91sam9x5ek:/# cd media/
root@at91sam9x5ek:/media# cd sda1
```

3) We can view the content with the command ls:

```
root@at91sam9x5ek:/media/sda1# ls
```

### 2.3 The use of SD card

1) The SD/MMC and MicroSD ports are available.

2) Insert the SD card into the port , the hyper-terminal will show the parameters of SD:

```
mmc0: host does not support reading read-only switch. assuming write-enable.
mmc0: new high speed SD card at address 1234
mmcblk0: mmc0:1234 SA02G 1.83 GiB
mmcblk0: detected capacity change from 0 to 19734200323
```

3) Enter the SD card with the command as below:

```
root@at91sam9x5ek:/# cd /media
```

4) We can view the content of SD with the command ls:

```
root@at91sam9x5ek:/media# ls
card      hdd      mmcblk0  ram      union
cf        mmc1    net      realroot
root@at91sam9x5ek:/media# cd mmcblk0
```

## 2.4 Play MP3 file

Before play, insert a headphone into the PHONE port. Store a MP3 file in the SD, and insert the SD card into the port. Enter the SD as 2.3.

Play the music using the command mplayer:

```
root@at91sam9x5ek:/media/mmcblk0# mplayer liunian.mp3
```

We can here the music with the headphone, enter any key to end.

## 2.5 Test the serial port

In default, MBS-SAM9X5 series output debug information through DBGU port, we can modify the configuration file to let the USART0 or USART3 to send and receive messages.

Connect the PC and the DBGU port, open the hyper-terminal(bond-rate: 115200, data bits: 8, parity: none, stop bit: 1, data flow control: none).

Reset the board, and modify the serial port configuration file:

```
at91sam9x5ek login: root
root@at91sam9x5ek:~# vi /etc/inittab
```

Find the ttyS0 in the configuration file, replace ttyS0 with ttyS1(replace ttyS0 with ttyS4 when use the USART3 port).

```
l0:0:wait:/etc/init.d/rc 0
l1:1:wait:/etc/init.d/rc 1
l2:2:wait:/etc/init.d/rc 2
l3:3:wait:/etc/init.d/rc 3
l4:4:wait:/etc/init.d/rc 4
l5:5:wait:/etc/init.d/rc 5
l6:6:wait:/etc/init.d/rc 6
# Normally not reached, but fallthrough in case of emergency.
z6:6:respawn:/sbin/sulogin
S:2345:respawn:/sbin/getty 115200 ttyS1
```

Safe the inittab file, reboot the Linux system, and we can send and receive messages with



the USART0 now.

## 2.6 Test TWI and EEPROM

Start the Linux system, and connect the PC and the DBGU port with serial cable, open the hyper-terminal (bond-rate: 115200, data bits: 8, parity: none, stop bit: 1, data flow control: none).

Enter these commands in the hyper-terminal:

```
at91sam9x5ek login: root
root@at91sam9x5ek:~# cd /sys/devices/platform/i2c-gpio.0/i2c-0/0-0051/
root@at91sam9x5ek:/sys/devices/platform/i2c-gpio.0/i2c-0/0-0051#
```

Write data to the EEPROM through I2C port:

```
root@at91sam9x5ek:/sys/devices/platform/i2c-gpio.0/i2c-0/0-0051# echo
"123456789" >eeprom
```

Read data from the EEPROM through I2C port:

```
root@at91sam9x5ek:/sys/devices/platform/i2c-gpio.0/i2c-0/0-0051# cat eeprom
123456789
```

Press Ctrl+C to end.

## 2.7 Test Ethernet 1

Before test, connect the board and PC with cross-over cable or connect the board to the switch.

1) Use ifconfig eth1 to check the current network configuration information:

```
root@at91sam9x5ek:~# ifconfig eth1
eth1      Link encap:Ethernet  HWaddr A2:6E:1A:1E:35:8B
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:27
```

2) Use ifconfig eth1 192.168.2.116 to set the IP address as 192.168.2.116:

```
root@at91sam9x5ek:~# ifconfig eth1 192.168.2.116
root@at91sam9x5ek:~# eth1: link up(100/Full)
```

3) We can Ping the board successfully on the PC, and the board can Ping the PC(the host IP is 192.168.2.72).

```

C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [版本 5.1.2600]
(C) 版权所有 1985-2001 Microsoft Corp.

C:\Documents and Settings\sx>ping 192.168.2.116

Pinging 192.168.2.116 with 32 bytes of data:

Reply from 192.168.2.116: bytes=32 time<1ms TTL=64
Reply from 192.168.2.116: bytes=32 time<1ms TTL=64
Reply from 192.168.2.116: bytes=32 time<1ms TTL=64
Reply from 192.168.2.116: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.2.116:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Documents and Settings\sx>

```

```

root@at91sam9x5ek:~# ping 192.168.2.72
PING 192.168.2.72 (192.168.2.72): 56 data bytes
64 bytes from 192.168.2.72: seq=0 ttl=64 time=6.117 ms
64 bytes from 192.168.2.72: seq=37 ttl=64 time=0.391 ms
64 bytes from 192.168.2.72: seq=38 ttl=64 time=0.411 ms
64 bytes from 192.168.2.72: seq=39 ttl=64 time=0.397 ms
64 bytes from 192.168.2.72: seq=40 ttl=64 time=0.411 ms
64 bytes from 192.168.2.72: seq=41 ttl=64 time=0.389 ms
64 bytes from 192.168.2.72: seq=42 ttl=64 time=0.388 ms
64 bytes from 192.168.2.72: seq=43 ttl=64 time=0.392 ms
64 bytes from 192.168.2.72: seq=44 ttl=64 time=0.391 ms
64 bytes from 192.168.2.72: seq=45 ttl=64 time=0.386 ms
64 bytes from 192.168.2.72: seq=46 ttl=64 time=0.405 ms

```

## 2.8 Test Telnet

1) Modify the MAC address

The default MAC address is 02-02-09-04-05-05

Modify the MAC address as below:

```

root@at91sam9x5ek:~# ifconfig eth1 down
root@at91sam9x5ek:~# eth1: link down

root@at91sam9x5ek:~# ifconfig eth1 hw ether 02:02:09:04:05:05
root@at91sam9x5ek:~# ifconfig eth1 up
root@at91sam9x5ek:~# eth1: link up (100/Full)

```

2) modify the gateway

- First, use ping 192.168.2.1 to check the network is available:

```
root@at91sam9x5ek:~# ping 192.168.2.1
PING 192.168.2.1 (192.168.2.1): 56 data bytes
64 bytes from 192.168.2.1: seq=0 ttl=64 time=9.013 ms
64 bytes from 192.168.2.1: seq=1 ttl=64 time=0.683 ms
64 bytes from 192.168.2.1: seq=2 ttl=64 time=1.170 ms
64 bytes from 192.168.2.1: seq=3 ttl=64 time=1.607 ms
64 bytes from 192.168.2.1: seq=4 ttl=64 time=1.064 ms
64 bytes from 192.168.2.1: seq=5 ttl=64 time=1.481 ms
```

- Then, use route add default gw 192.168.2.1 to set the default gateway:

```
root@at91sam9x5ek:~# route add default gw 192.168.2.1
```

- Use ping 202.112.17.137 to check connection:

```
root@at91sam9x5ek:~# ping 202.112.17.137
PING 202.112.17.137 (202.112.17.137): 56 data bytes
64 bytes from 202.112.17.137: seq=0 ttl=64 time=7.787 ms
64 bytes from 202.112.17.137: seq=1 ttl=64 time=0.403 ms
64 bytes from 202.112.17.137: seq=2 ttl=64 time=0.399 ms
64 bytes from 202.112.17.137: seq=3 ttl=64 time=0.382 ms
64 bytes from 202.112.17.137: seq=4 ttl=64 time=0.396 ms
64 bytes from 202.112.17.137: seq=5 ttl=64 time=0.397 ms
```

```
--- 202.112.17.137 ping statistics ---
```

```
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max = 0.382/1.627/7.787 ms
```

- 3) Use telnet 202.112.17.137 to visit BBS forum.

```

root@at91sam9x5ek:~# telnet 202.112.17.137

  华南木棉BBS 最近 (1,10,15) 分钟平均负荷为 0.18 0.11 0.35  [负荷正常]

Entering character mode.
Escape character is '^]'.

★※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※★
※
※          欢 迎 莅 临          ※
※      中国教育和科研计算机网(CERNET)华南地区网络中心      ※
※          电子公告牌华南网木棉站          ※
※
※      本站地址: bbs.gznet.edu.cn (202.112.17.137)      ※
※
◇      Warmly Welcome to Bulletin Board Service(BBS) of      ◇
◇      CERNET Southern Regional Center      ◇
◇
◇      If you have any problems, please send email to      ◇
◇      scutbbs@scut.edu.cn      ◇
◇
※      请用户遵守国家法律和CERNET用户守则, 谢谢合作!      ※
◎
★※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※※★

欢迎光临【华南木棉BBS】 [ Add '.' after YourID to login for BIG5 ]
目前上站人数: [7/25000]。 最高人数记录: [12970]。
请输入帐号(试用请输入 'guest'):
```

5) Configure the DNS to visit external network.

- Use ipconfig -all to know that the local DNS is 202.103.24.68
- Use touch /etc/resolv.conf to create command

```
root@at91sam9x5ek:~# touch /etc/resolv.conf
```

- Use echo nameserver 202.103.24.68 >> /etc/resolv.conf

```
root@at91sam9x5ek:~# echo nameserver 202.103.24.68 >> /etc/resolv.conf
```

- Use ping [www.baidu.com](http://www.baidu.com) to test whether can visit external network or not

```

root@at91sam9x5ek:~# ping www.baidu.com
PING www.baidu.com (119.75.217.56): 56 data bytes
64 bytes from 119.75.217.56: seq=0 ttl=54 time=129.167 ms
64 bytes from 119.75.217.56: seq=1 ttl=54 time=93.901 ms
64 bytes from 119.75.217.56: seq=2 ttl=54 time=90.289 ms
64 bytes from 119.75.217.56: seq=3 ttl=54 time=56.391 ms
64 bytes from 119.75.217.56: seq=4 ttl=54 time=48.588 ms
64 bytes from 119.75.217.56: seq=5 ttl=54 time=47.948 ms
64 bytes from 119.75.217.56: seq=6 ttl=54 time=68.334 ms
Access the external network successfully.
```

# Chapter 3 System Compilation

## 3.1 Linux system principles

### 3.1.1 The mirror package description

<b>at91sam9x5ek-nandflashboot-3.1.bin</b>	guidance program compiled by AT91Bootstrap
<b>u-boot.bin</b>	Compiled by uboot source code from uboot start programs
<b>ulmage</b>	Linux kernel file
<b>Angstrom-x11-at91sam9-image-eglbc-ipk-v20110624-at91sam9x5ek.rootfs.ubi</b>	Angstrom filesystem
<b>at91sam9x5ek_demo_linux_nandflash.tcl</b>	Download record
<b>at91sam9x5ek_demo_linux_nandflash.bat</b>	Auto download tools

### 3.1.2 Principles of system operation

After power on, system starts from nandflash, due to the nature of hardware design:

1. First, at91sam9x5ek-nandflashboot-3.1.bin will be copied to SRAM; when it runs, it initializes the hardware, and copies uboot.bin to DDRAM;
2. Uboot.bin runs in DDRAM, and the copies ulmage to DDRAM;
3. Linux starts, and ulmage runs in DDRAM;
4. Angstrom starts, the Linux system runs.

## 3.2 File system compilation

With the source code and patch, we can compile the Linux image package for MBS-SAM9X5.

### 3.2.1 Preparation

(1) Create a working directory

```
# mkdir /home/Embest_SAM9X5
# cd /home/Embest_SAM9X5
```

(2) Copy the 06-Linux\_Source to the /home/Embest\_SAM9X5. Don't change their names.

### 3.2.2 Install the cross compiler tools

```
# tar xvjf 06-Linux_Source/Official_Code/CrossTool/arm-2007q1-10-arm-none-linux-gnueabi.tar.bz2 -C /usr/local
```

### 3.2.3 Get at91bootstrap by compiling the AT91Bootstrap source file

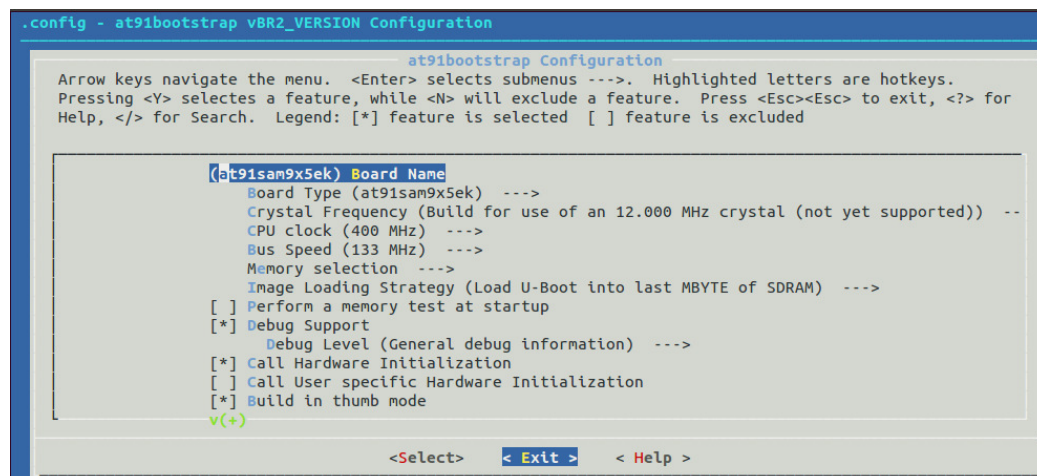
(1) Install

```
# tar xvfz 06-Linux_Source/Official_Code/AT91Bootstrap/AT91Bootstrap-5series_1.2.tgz
```

(2) Compile

```
# cd AT91Bootstrap-5series_1.2
# make distclean CROSS_COMPILE=/usr/local/arm-2007q1/bin/arm-none-linux-gnueabi-
# make at91sam9x5nf_defconfig
# make menuconfig
```

It will show the configuration information:



Without any changes, select "Exit" to exit.

```
# make CROSS_COMPILE=/usr/local/arm-2007q1/bin/arm-none-linux-gnueabi-
```

We can see the **at91sam9x5ek-nandflashboot-3.1.bin**.

### 3.2.3 Compile the U-boot source code to get u-boot.bin

(1) Install

```
# cd 06-Linux_Source/Official_Code/u -boot/
# tar xvjf u-boot-2010.06.tar.bz2
# cp u-boot-5series_1.0.patch u-boot-2010.06
# cd u-boot-2010.06
# patch -p1 < u-boot-5series_1.0.patch
# patch -p1 < ../../../../Embest_Code/u-boot/u-boot-5series_1.0.diff
```

Compile it:

```
# make at91sam9x5ek_nandflash_config
# make CROSS_COMPILE=/usr/local/arm-2007q1/bin/arm-none-linux-gnueabi-
# ls
```

We can see the **u-boot.bin**.

### 3.2.4 Compile the Linux kernel source code to get the u-Image file

Install

```
# cd 06-Linux_Source/Official_Code/linux_kernel_2.6.30/
# tar xvjf linux-2.6.39.tar.bz2
# cp 2.6.39-at91-exp.tar.gz linux-2.6.39
# cd linux-2.6.39/
# tar xvzf 2.6.39-at91-exp.tar.gz
# for p in 2.6.39-at91-exp/* ; do patch -p1 < $p ;done
#patch -p1 < ../../../../Embest_Code/kernel/embest_code.diff
```

Enter the kernel source directory:

Configuration file (select the file according to the LCD size)

LCD type	Configuration files
LCD_4.3	embest_MBS-SAM9X5_4.3lcd_defconfig
LCD_7.0	embest_MBS-SAM9X5_7.0lcd_defconfig
LCD_10.2	embest_MBS-SAM9X5_10.2lcd_defconfig

```
# cp arch/arm/configs/Configuration files .config
```

If we want to get the image file for 7.0, enter:

```
# cp arch/arm/configs/embest_MBS-SAM9X5_7.0lcd_defconfig .config
```

Compile it:

```
# make ARCH=arm menuconfig
```

```
# make uImage ARCH=arm CROSS_COMPILE=/usr/local/arm-2007q1/bin/arm-none-linux-gnueabi-
```

Note: only you install uImage tool in your Ubuntu can use "make uImage" command. Or install it as below

```
# apt-get install uboot-mkimage
```

We will get the **uImage** under the directory of arch/arm/boot/



## Chapter 4 Resource List

Note:

(1) “√”--included, “×”-- not included;

(2) Free and open

Categories	Drivers	9G15	9G25	9G35	9X25	9X35	9x5	
Bootloader	AT91Bootstrap	Lead Uboot					tested, free&open	
	Uboot	1. NandFlash erasing ,reading and writing 2.support network download images 3. Support the establishment, save the environment variable 4. Support the memory contents display, contrast, and modification 5. Support bootm、bootargs settings					tested, free&open	
kernel	net	ETH0	×	√	√	√	√	tested, free&open
		ETH1	×	×	×	√	×	tested, free&open
	serial	USART0	√	√	√	√	√	tested, free&open
		USART3	×	√	×	√	×	tested, free&open
		DBGU	√	√	√	√	√	tested, free&open
	CAN	CAN0	×	×	×	√	√	untested, provide codes
		CAN1	×	×	×	√	√	untested, provide codes
	USB	USB_HOST* 2	√	√	√	√	√	tested, free&open
		USB_OTG	√	√	√	√	√	tested, free&open
		SMD驱动	√	√	√	√	√	provide hardware interface only
	SDcard	MicroSD	√	√	√	√	√	tested, free&open
		SDCard	√	√	√	√	√	tested, free&open
		camera (ISI)	×	√	×	×	×	untested, provide codes
		LCD+touch	√	×	√	×	√	tested, free&open
		Zigbee	√	√	√	√	√	provide hardware interface only
	SPI	√	√	√	√	√	reuse, unregistered	

							equipment
	TWI	√	√	√	√	√	tested, free&open
	Qtouch	√	√	√	√	√	tested, free&open
	DMA	√	√	√	√	√	tested, free&open
	GPIO	√	√	√	√	√	tested, free&open
<b>File system</b>	Angstrom	√	√	√	√	√	provide file system
	Android	√	x	√	x	√	provide file system

## Appendix Sales and Technical Support

### Sales

Tel: 0755-25621715

Fax: 0755-25616057

E-mail: [sales.en@embedinfo.com](mailto:sales.en@embedinfo.com)

### Technical support

Tel: 027-87290817

E-mail: [support.en@embedinfo.com](mailto:support.en@embedinfo.com)

URL: <http://www.embedinfo.com/en/>