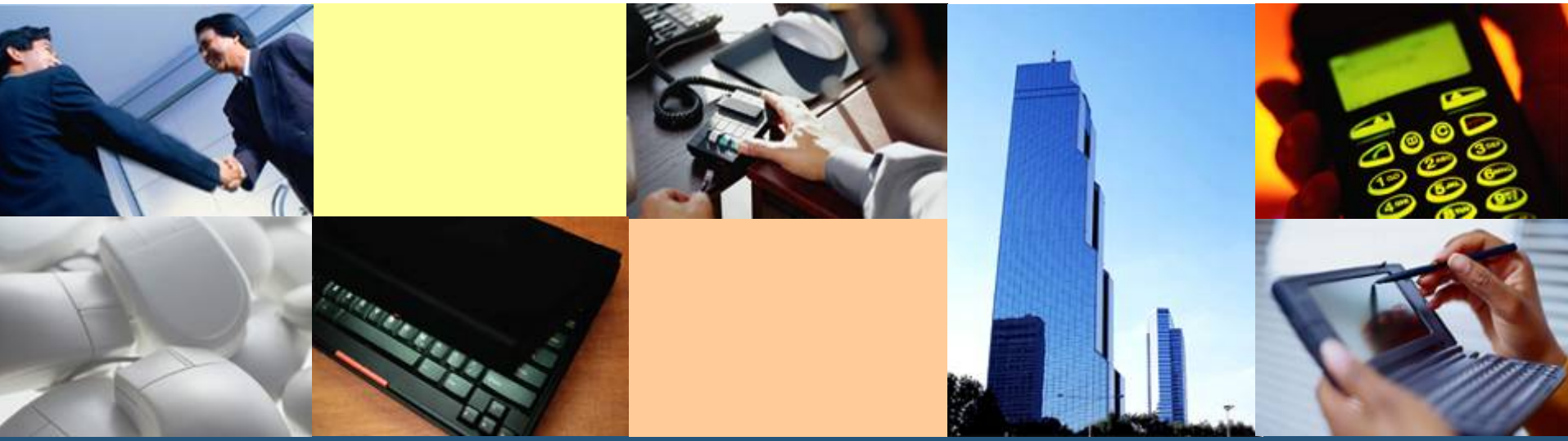
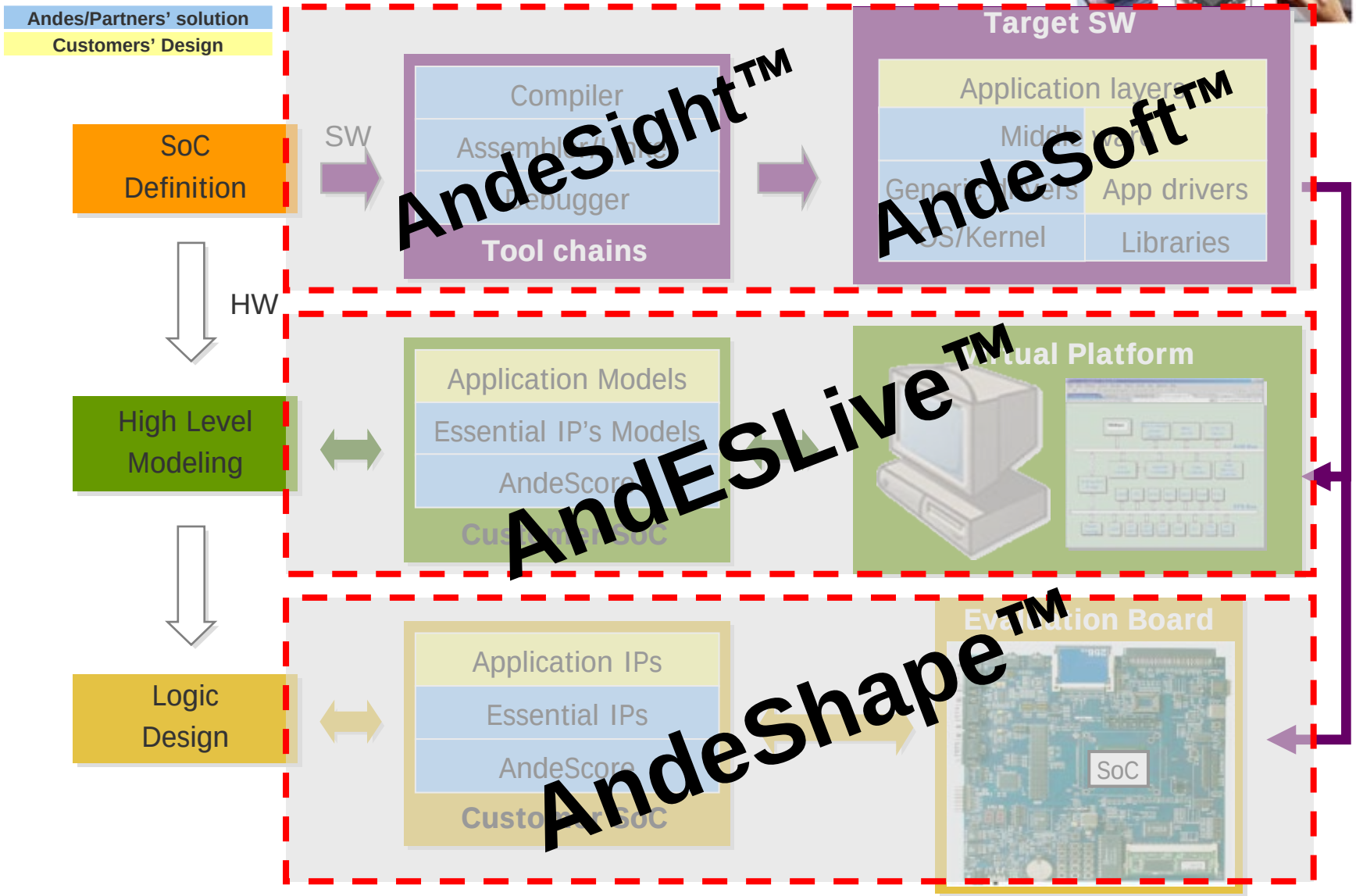
Andes SoC Development Solution Training Course



Andes University Program

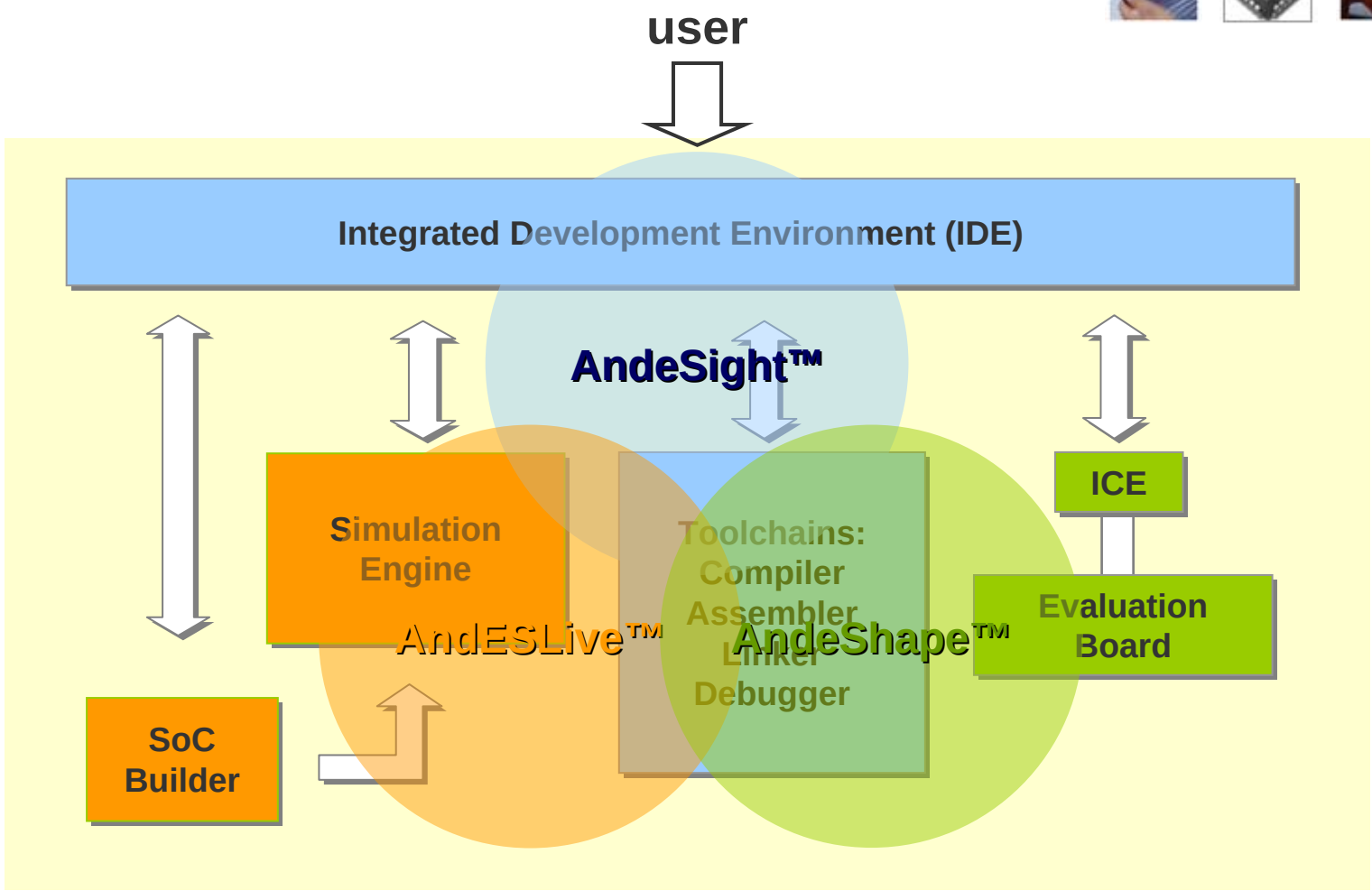
- 晶心科技股份有限公司為支持NSoC鼓勵大學及研究所研發嵌入式系統晶片相關之軟體及硬體，特成立Andes University Program專案計劃
- 邀請嵌入式軟體硬體相關先進之研發單位及研發團隊加入， 期能促成產學研共同開發，協助人才技術之先期培育，進而鼓勵週邊配合應用，並使晶心的產品更符合嵌入式系統晶片之需求
- 本計劃由NSoC **晶片系統國家型科技計畫辦公室**及**晶心科技**主辦，**聯發科技**協辦

SoC Development Flow



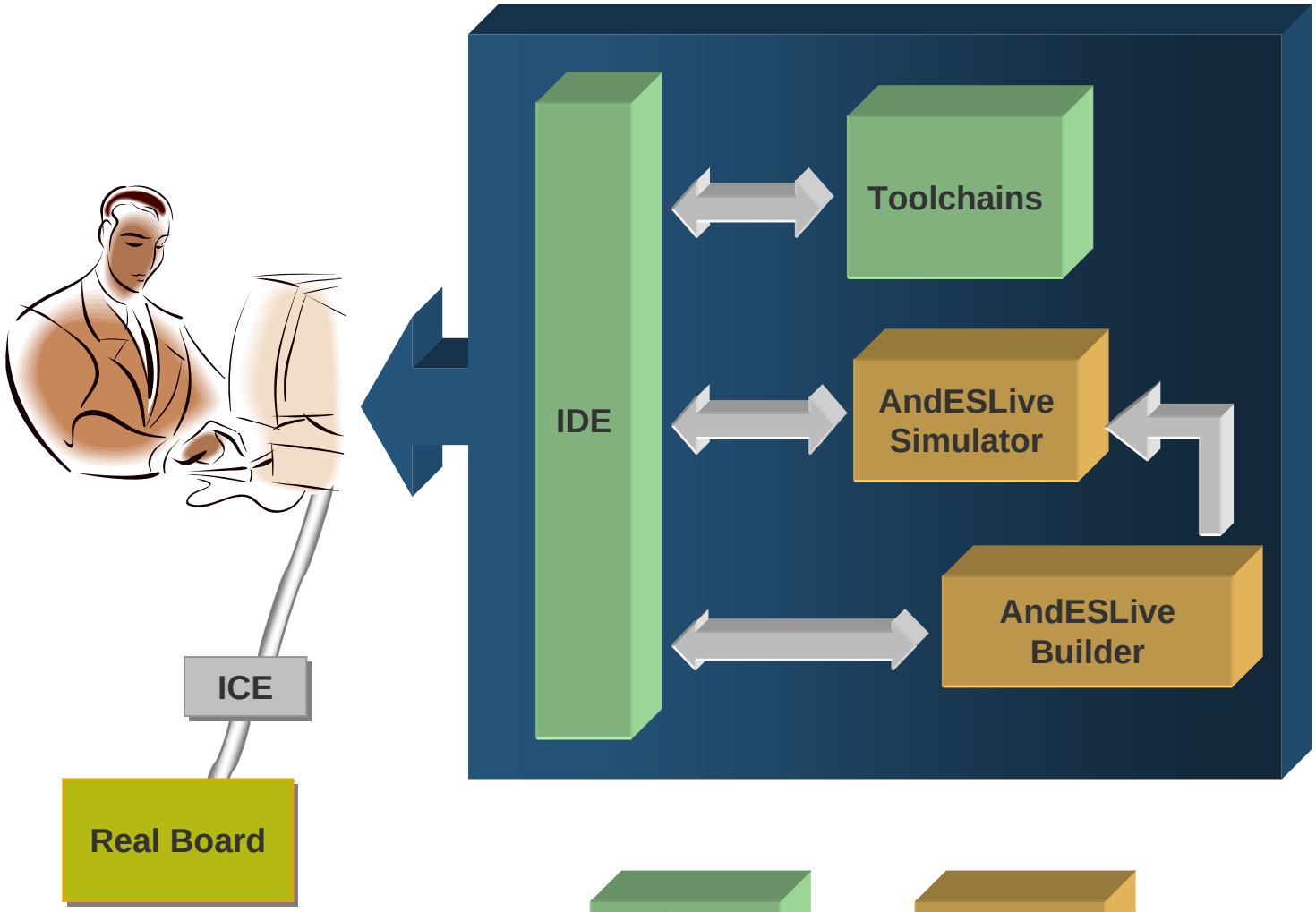
ANDES TECHNOLOGY

Andes Total SW Solution

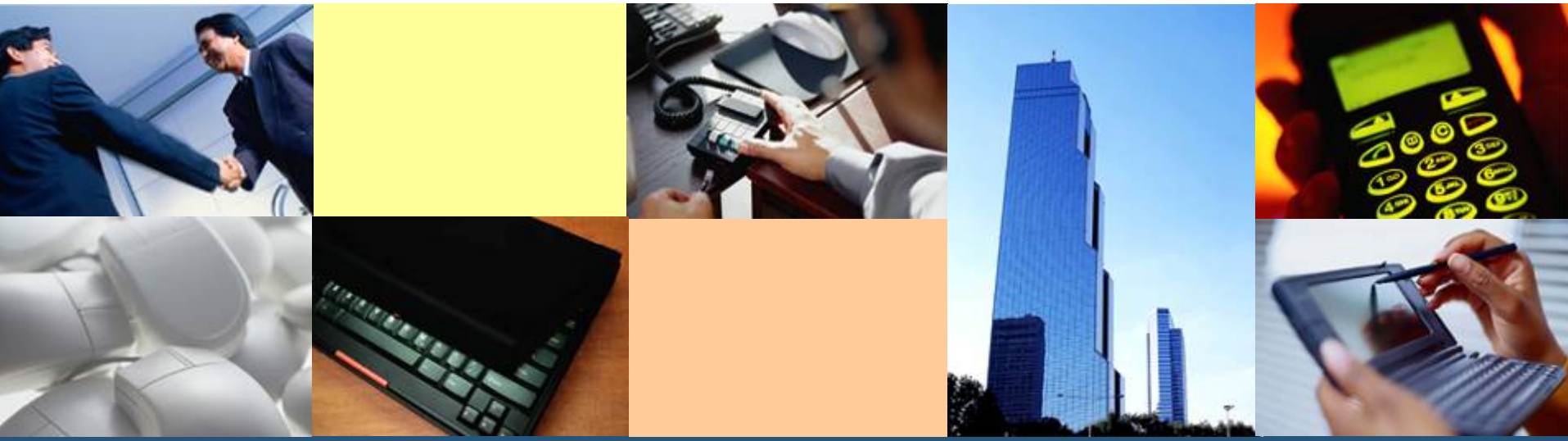


Andes SW Solution = AndESLive™ + AndeSight™ + AndeShape™

Unified and Integrated Environment

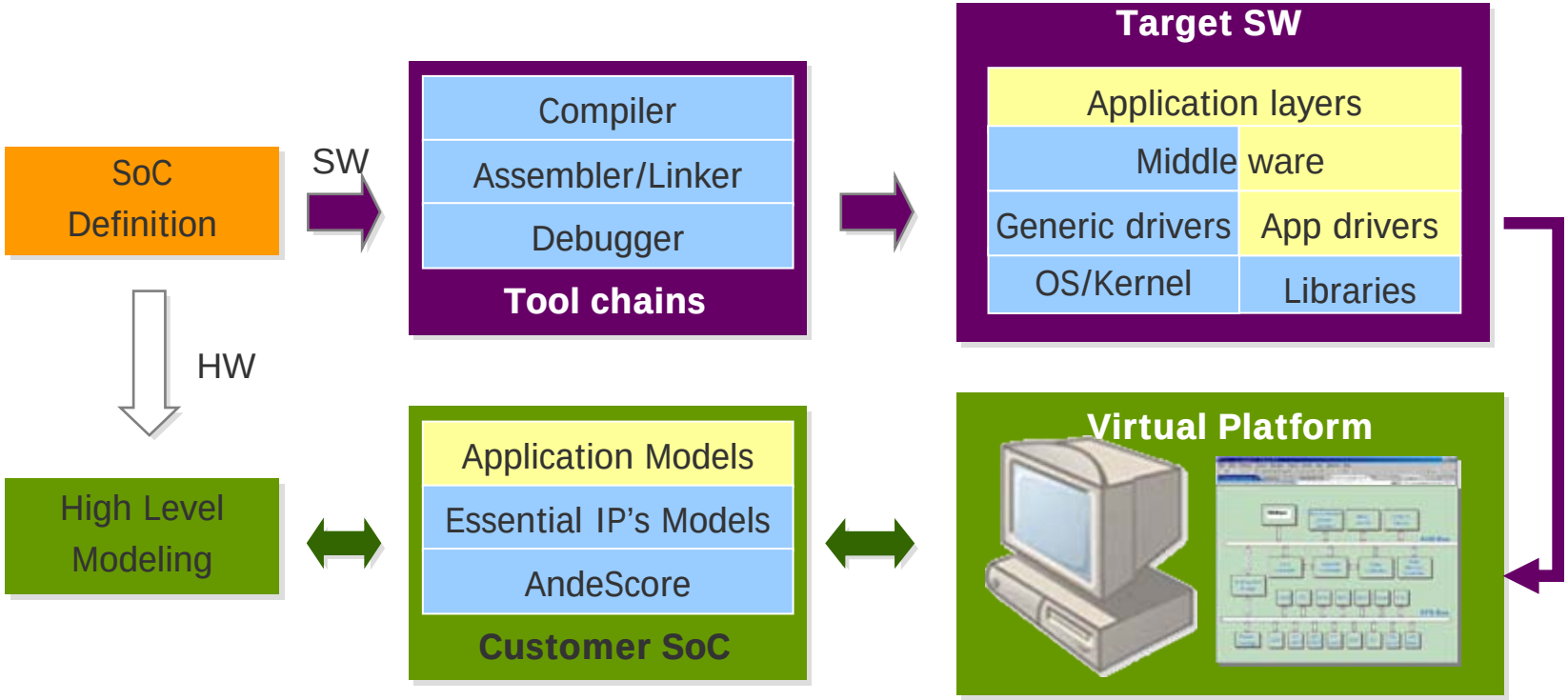


AndESLive & AndeSight



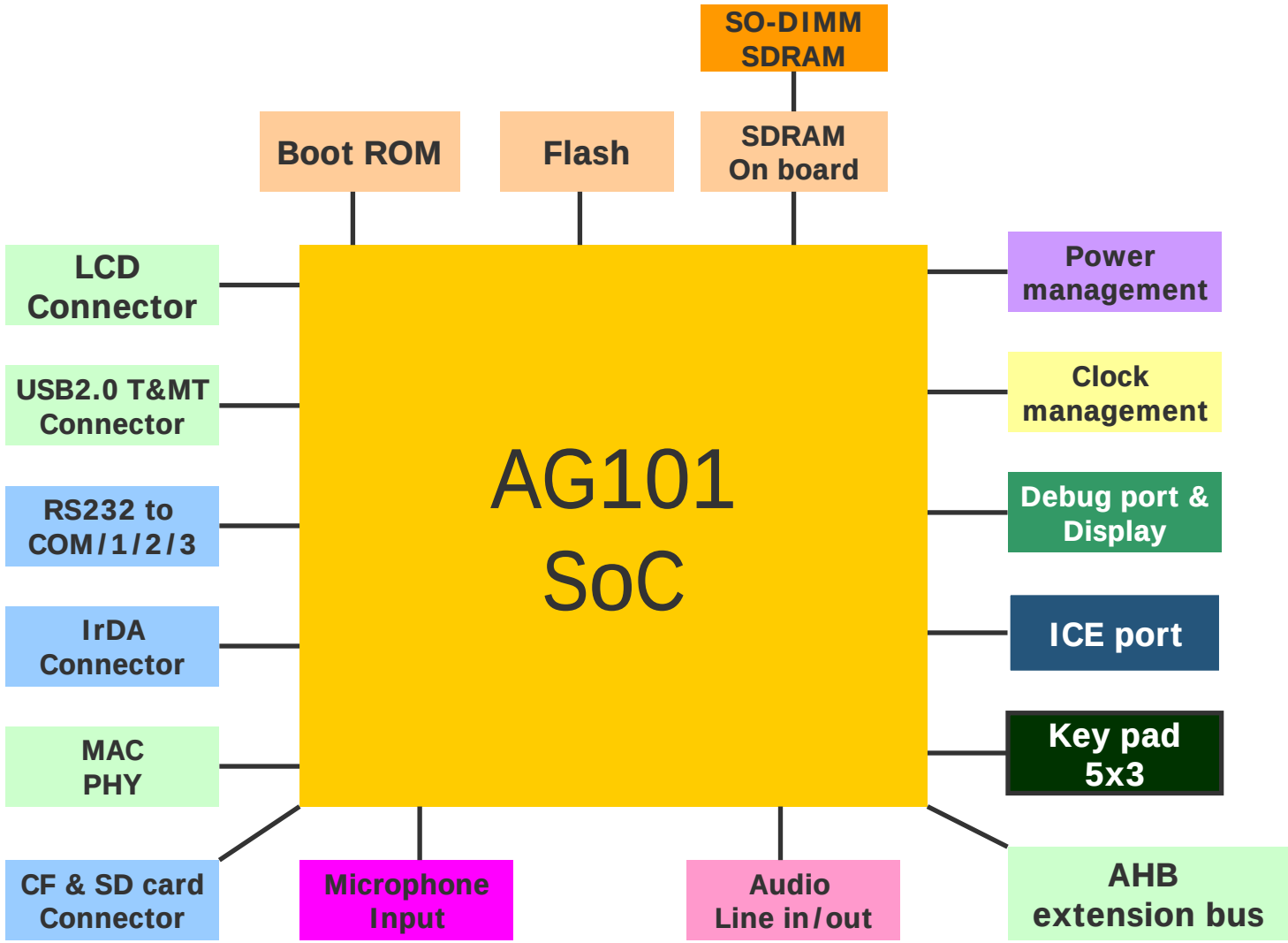
Modeling and Software Development

Andes/Partners' solution
Customers' Design



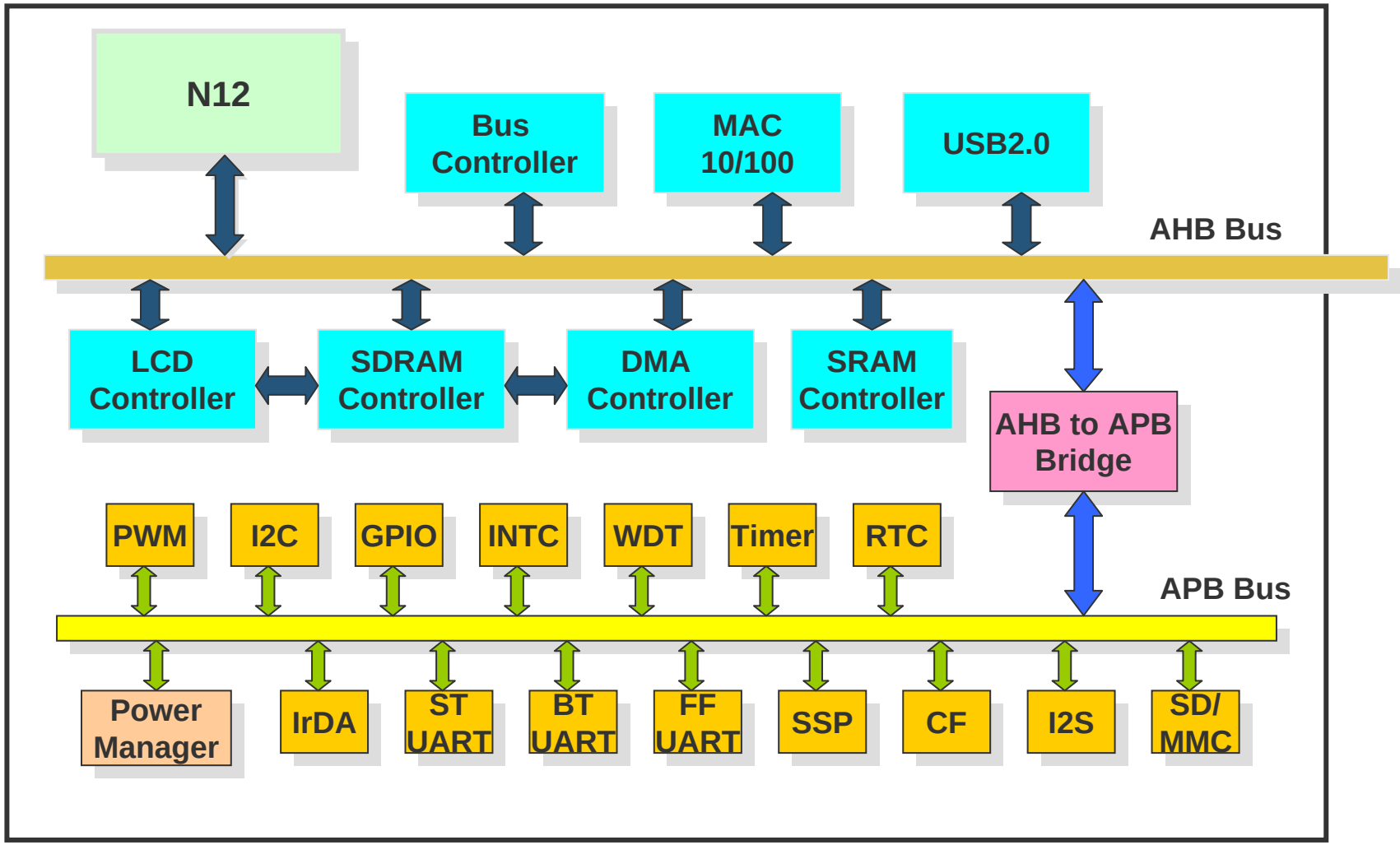
ANDES TECHNOLOGY

AndESLive Platform



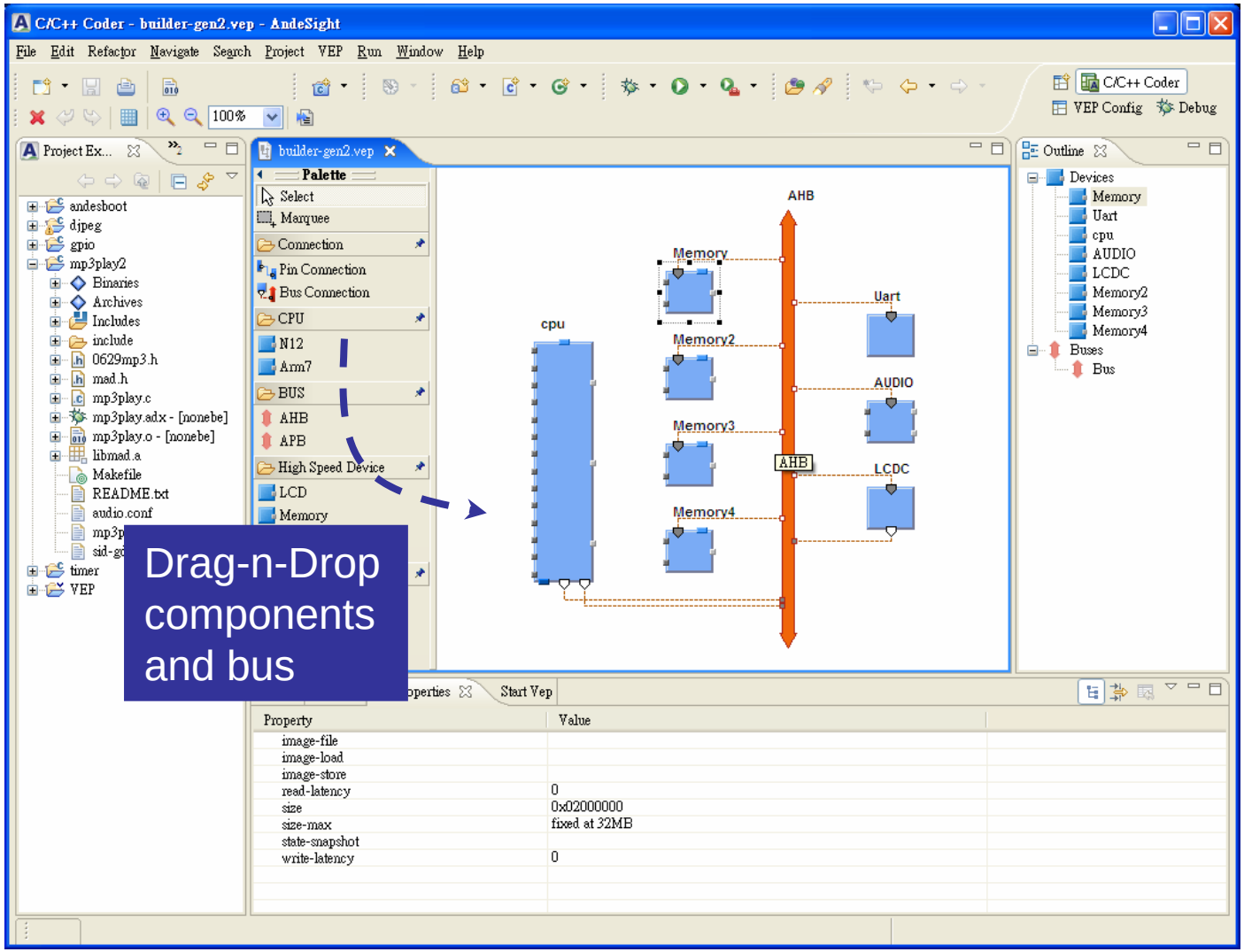
ANDES TECHNOLOGY

AndeShape™ Platform SoC: AG101



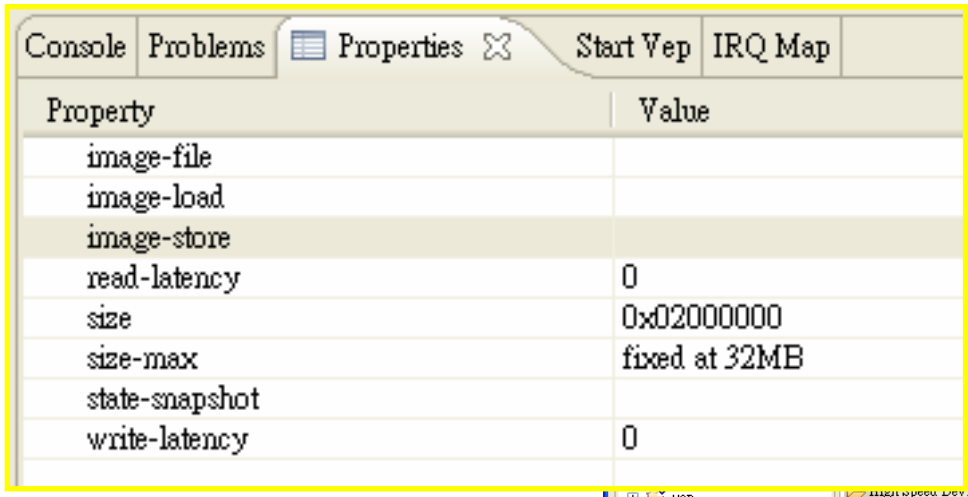
ANDES TECHNOLOGY

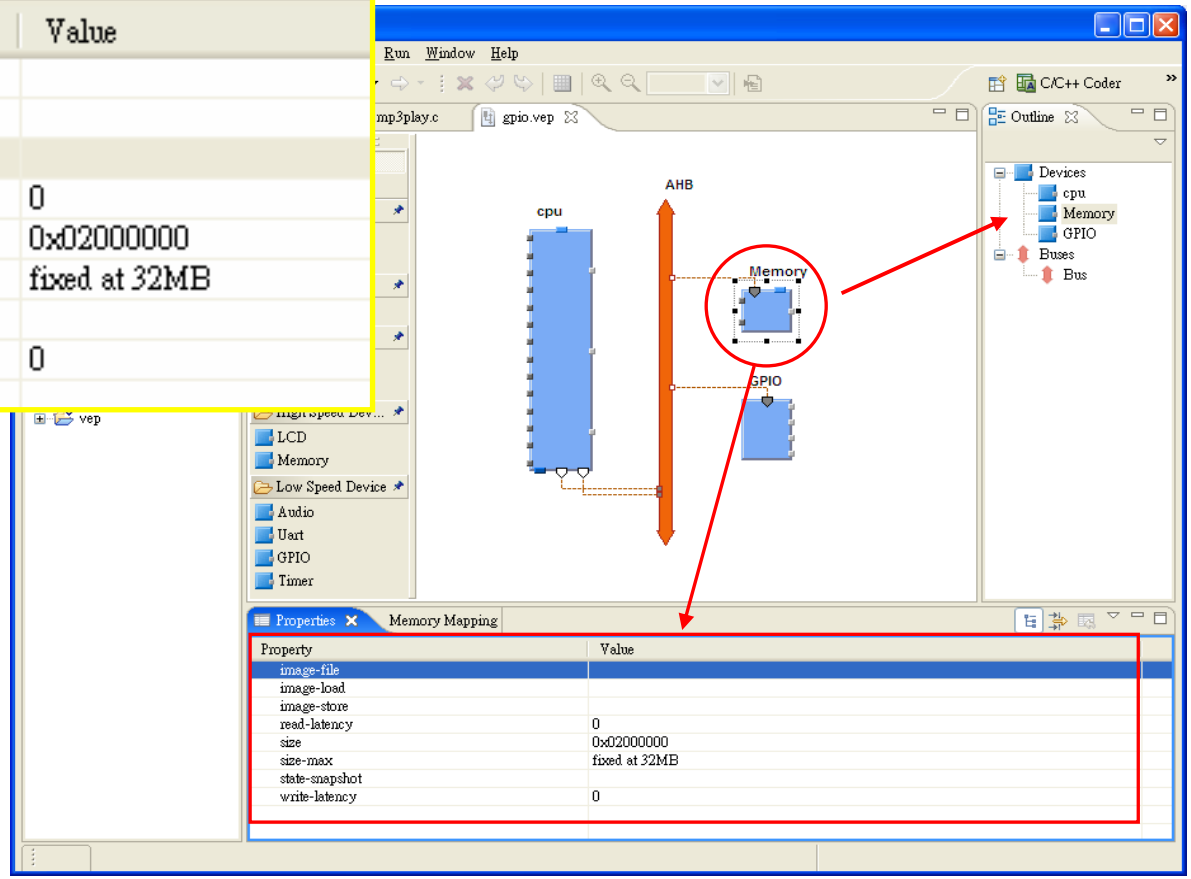
AndESLive Builder



ANDES TECHNOLOGY

Components Properties



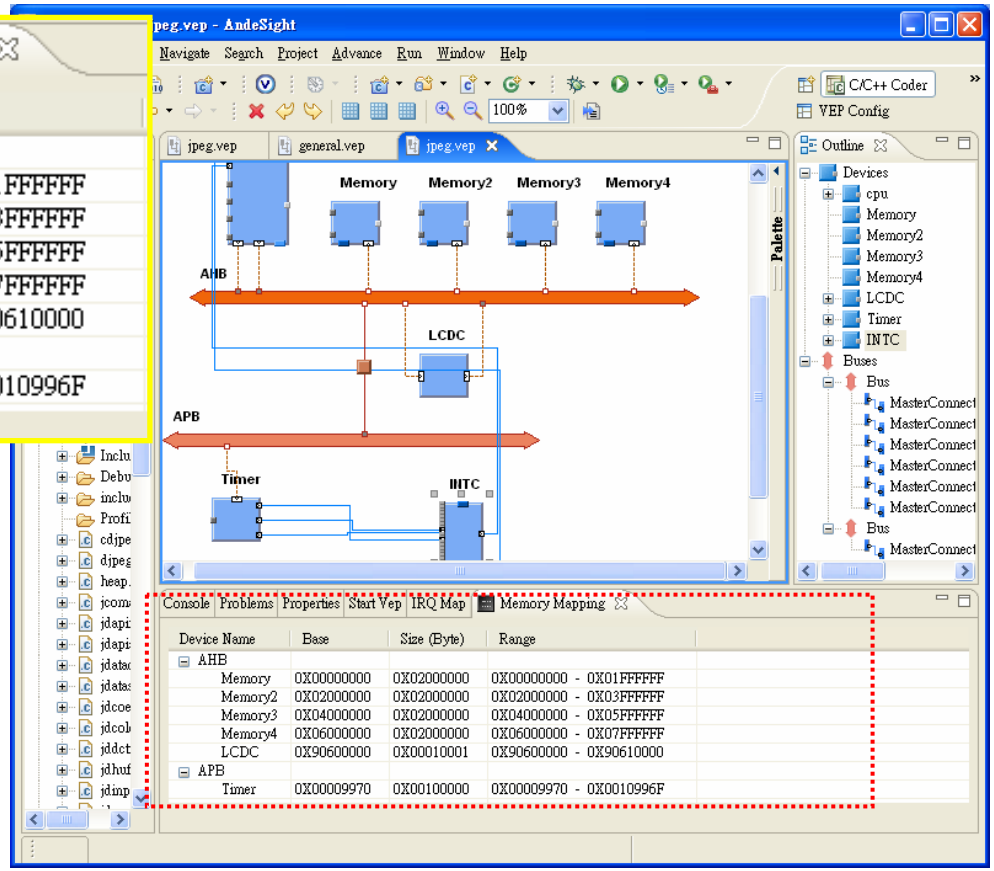


- Click on component to show Properties
- Click on entry of Properties view to modify its value

Memory Mapping

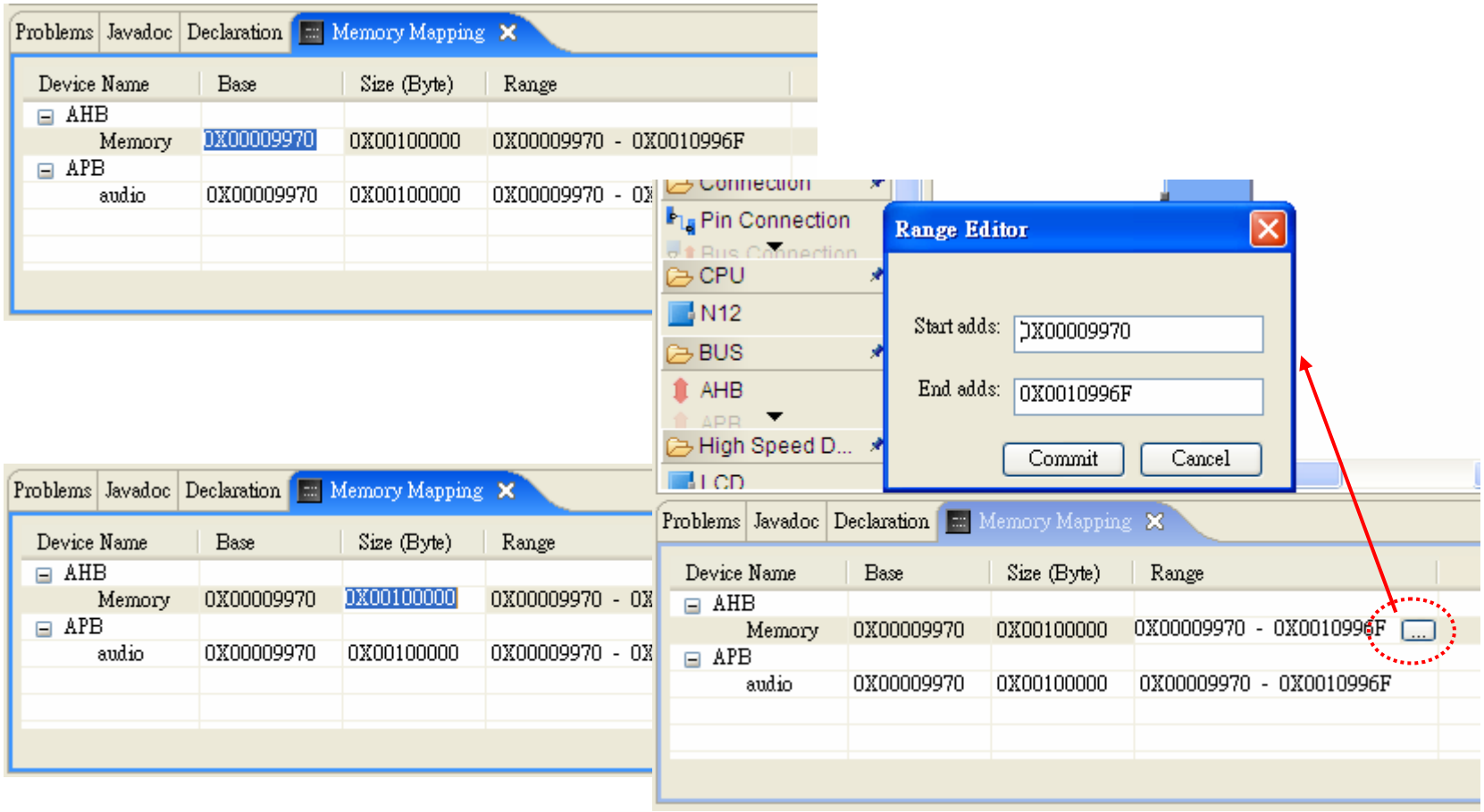
Console | Problems | Properties | Start Vep | IRQ Map | Memory Mapping

Device Name	Base	Size (Byte)	Range
AHB			
Memory	0X00000000	0X02000000	0X00000000 - 0X01FFFFFF
Memory2	0X02000000	0X02000000	0X02000000 - 0X03FFFFFF
Memory3	0X04000000	0X02000000	0X04000000 - 0X05FFFFFF
Memory4	0X06000000	0X02000000	0X06000000 - 0X07FFFFFF
LCDC	0X90600000	0X00010001	0X90600000 - 0X90610000
APB			
Timer	0X00009970	0X00100000	0X00009970 - 0X0010996F



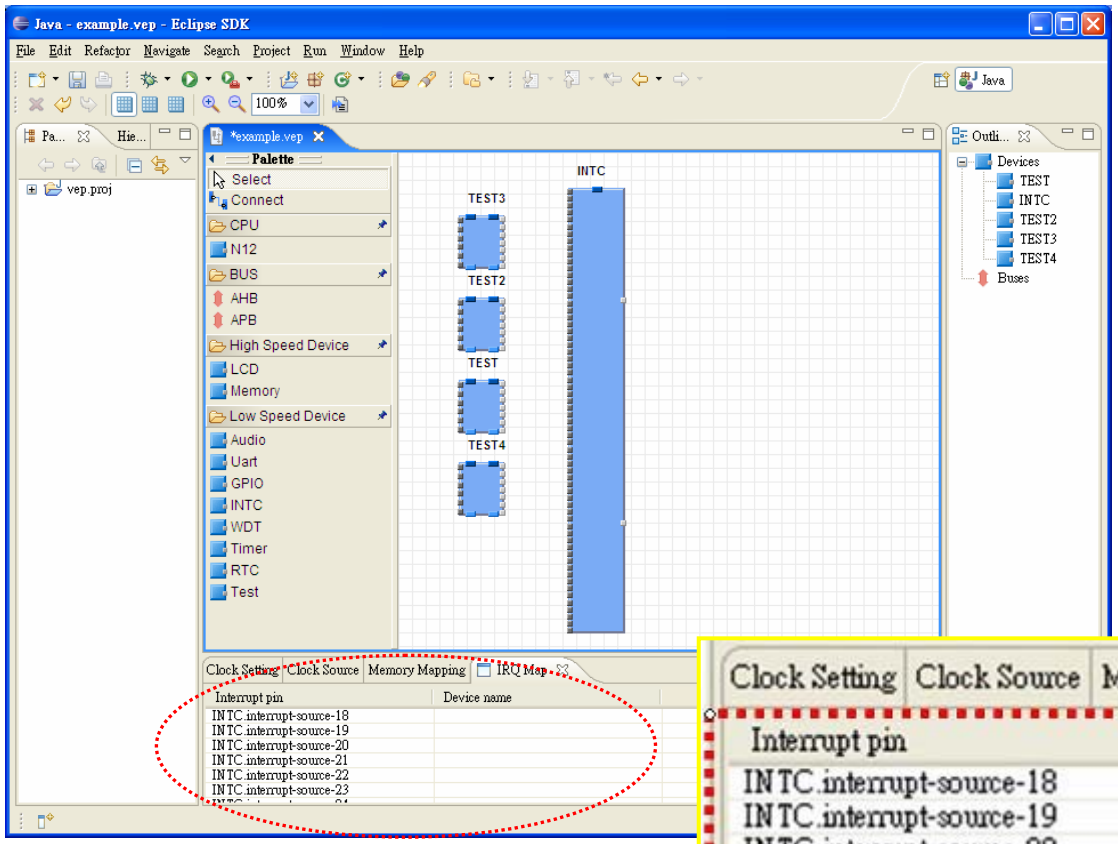
- Memory Mapping shows mapping of all components
- Group into AHB and APB

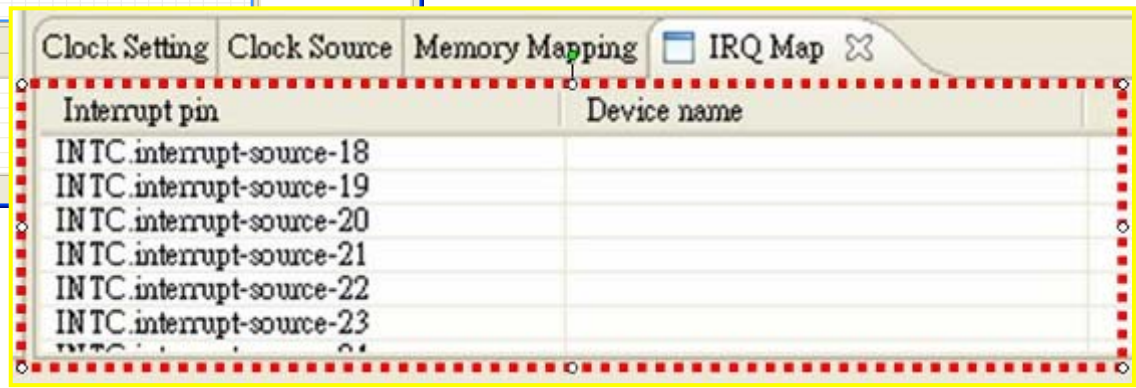
Memory Map Editing



ANDES TECHNOLOGY

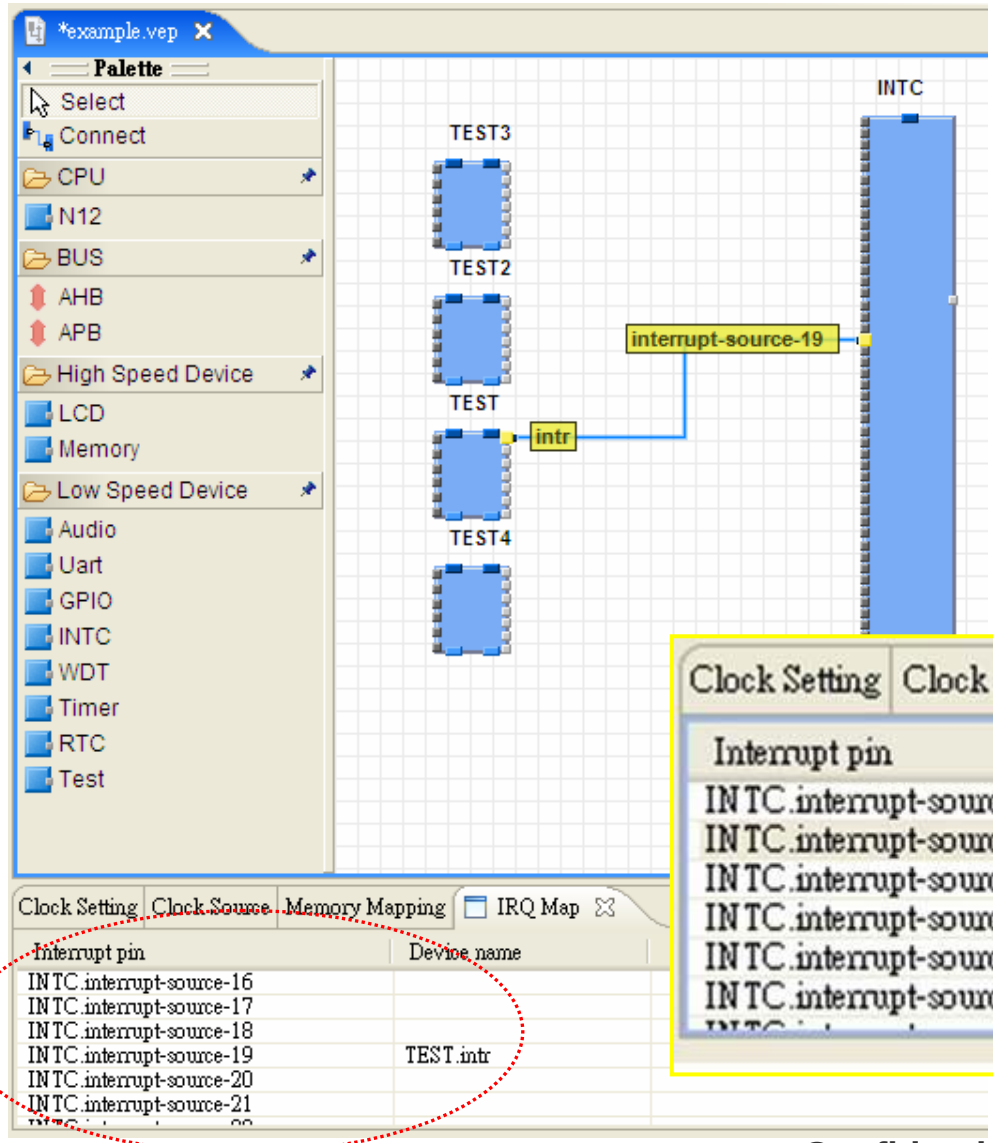
Interrupt

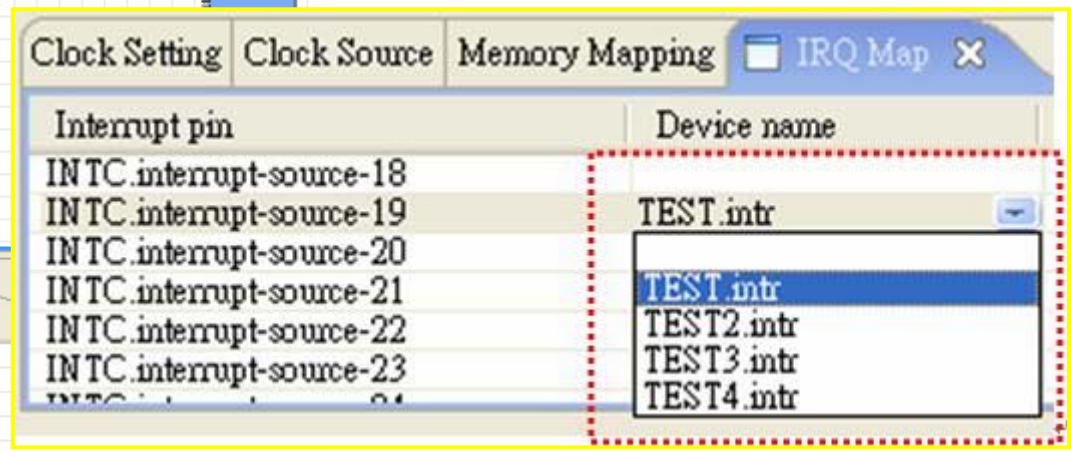




- Add an interrupt controller INTC
- IRQ Map will be added with interrupt pins of INTC

Interrupt Pin



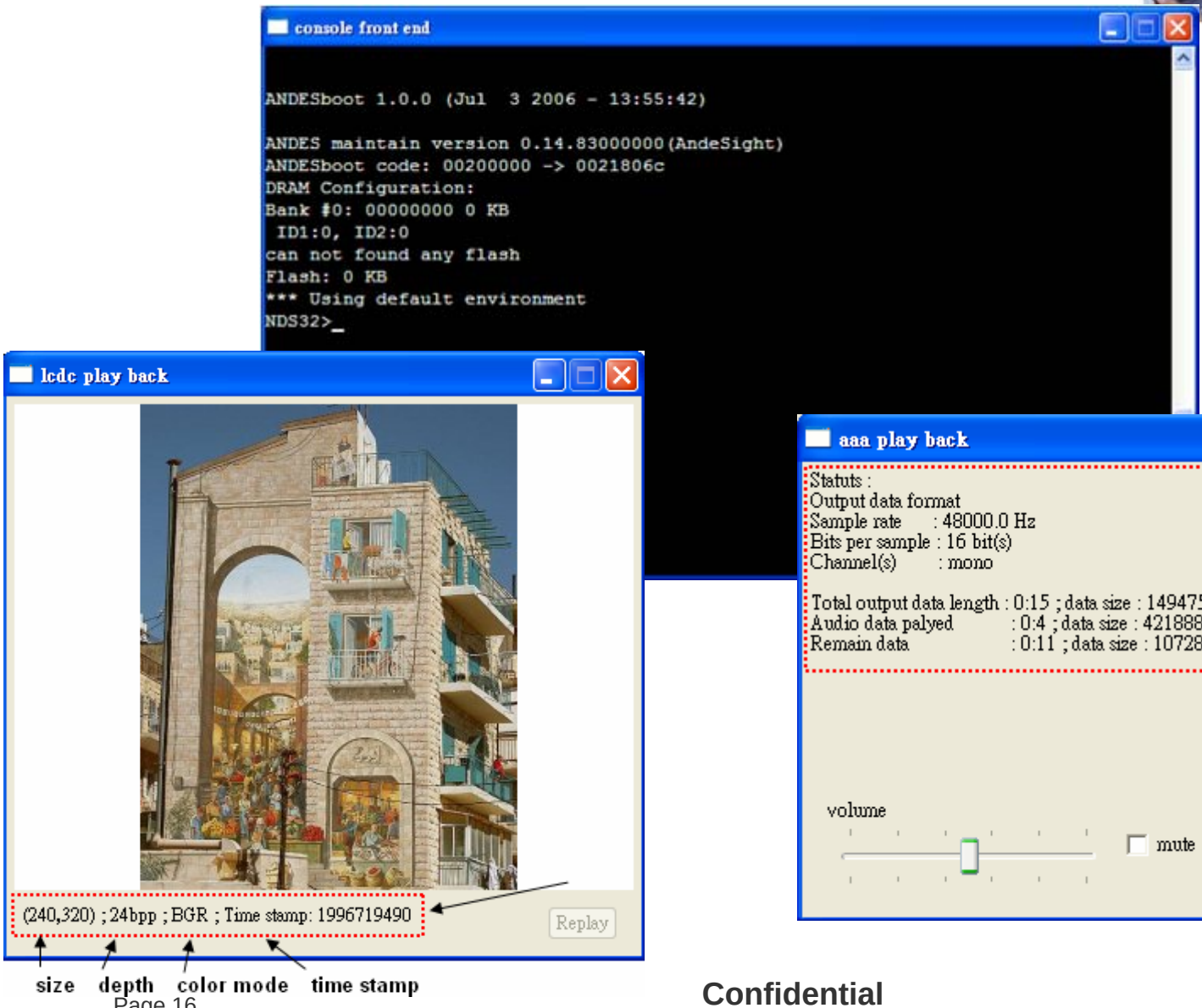


- Connect the device to interrupt pin

or

- Select device intr by drop-down menu

AndESLive I/O Devices



ANDES TECHNOLOGY

OS & Libraries Supports

- OS
  - Linux 2.4 (available now) , 2.6
  - Nucleus (2007)
  - uCLinux (2007)
  - uITron (2007)
- Windows Manager (2007)
- Libraries
  - Standard C/C++ libraries
  - Drivers of AG101 components

Andes Total SW Solution

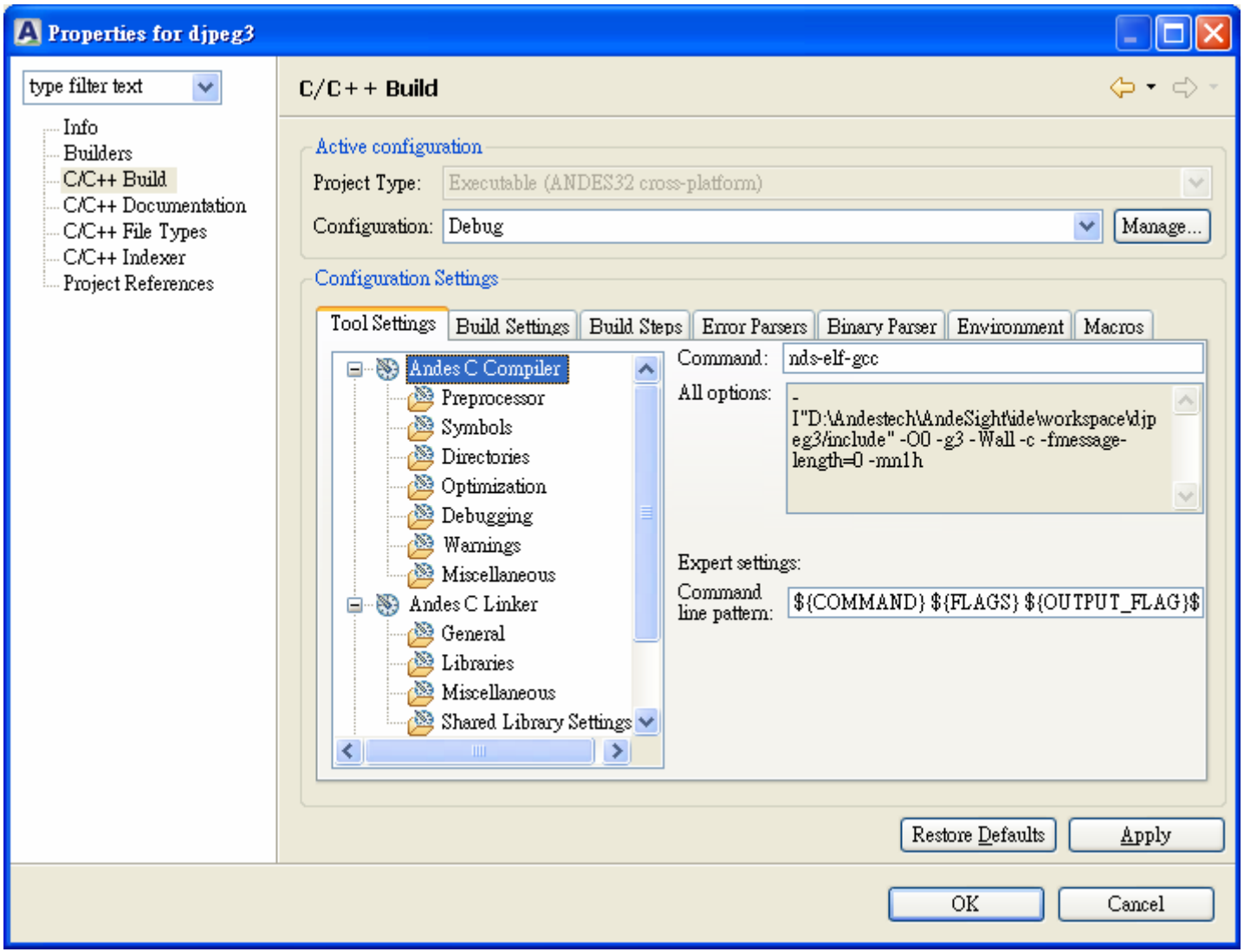
user

Integrated Development Environment (IDE)

- Specify options to Toolchains by Project Properties form
- Can use cygwin shell for batch mode

Toolchains:
Compiler
Assembler
Linker
Debugger

Build Options



Compiler

❖ Compiler Optimization

- 32-bit to 16-bit Instructions Conversion

```
add r5, r6 ,r7   ➔   add333 r5, r6, r7
```

To reduce code size

- Post-increment Instructions

```
lw      r5, [r4]
addi45 r4, 4     ➔   lwi.p r5, [r4], 4
```

To reduce a latency of 1 cycle and code size of 1 instruction

Compiler

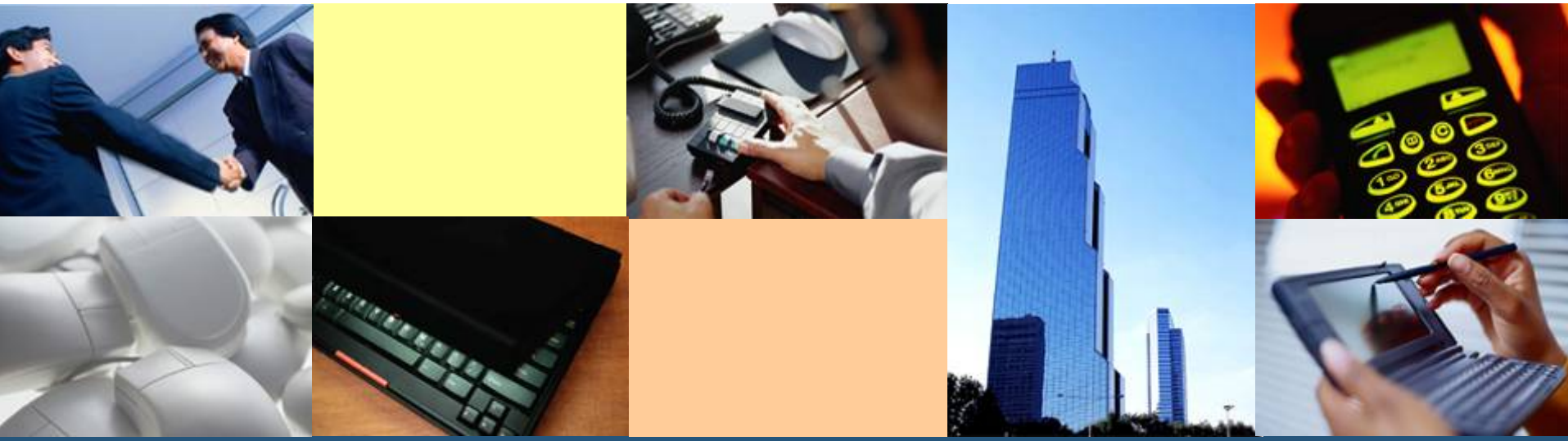
- D-cache manipulation instructions

```
label_1:
    ...
    lw      r1, [r2 + (r3 << 2)]
    addi    r3, r3, 1
    ...
    j       label_1
```

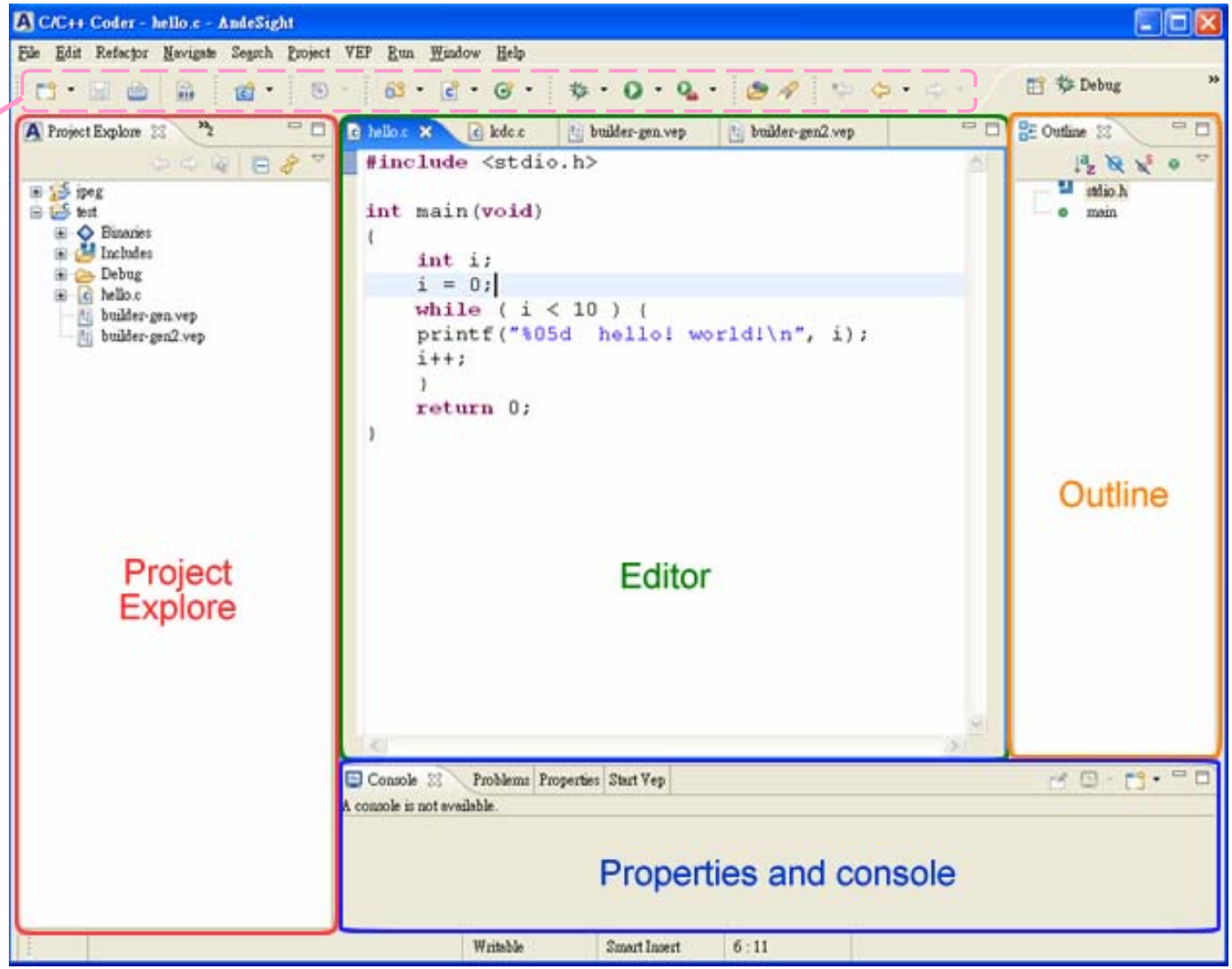
To avoid latency of D-cache miss by prefetch

```
label_1:
    ...
    lw      r1, [r2 + (r3 << 2)]
    addi    r3, r3, 1
    DPREFI.w SRD, [r2 + (r3 << 2)]   ! data prefetch
    ...
    j       label_1
```

AndeSight Overview

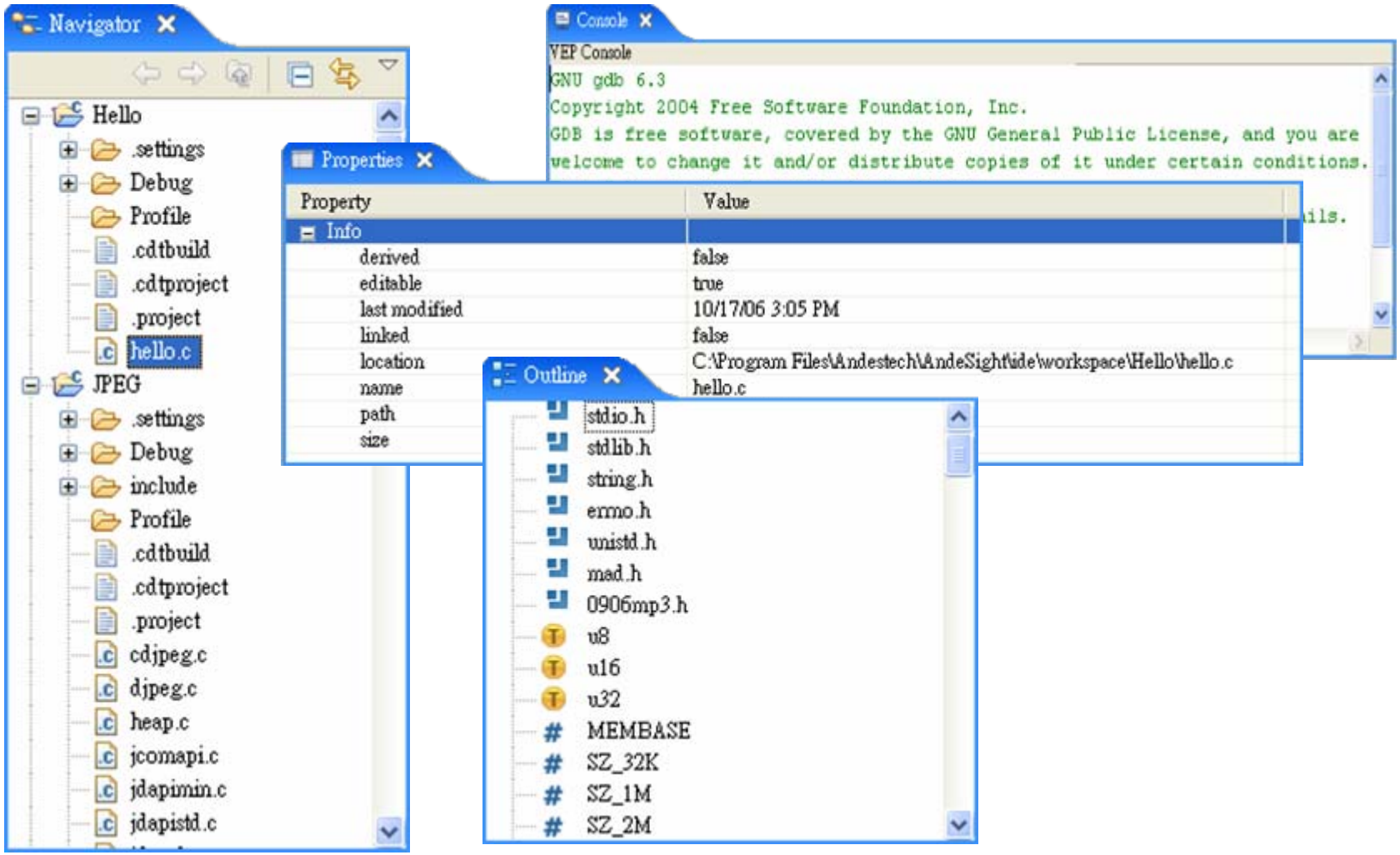


AndeSight UI

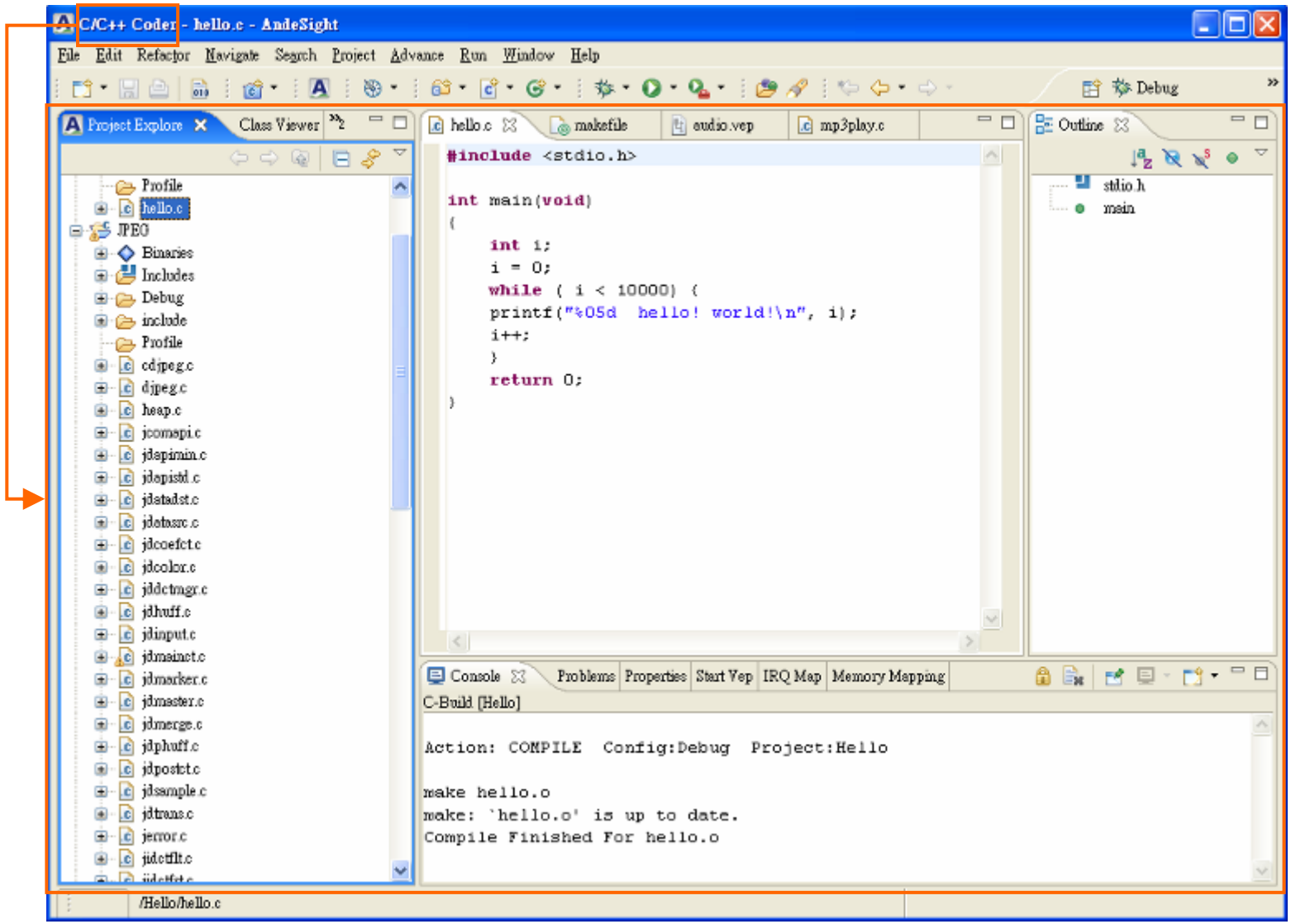


ANDES TECHNOLOGY

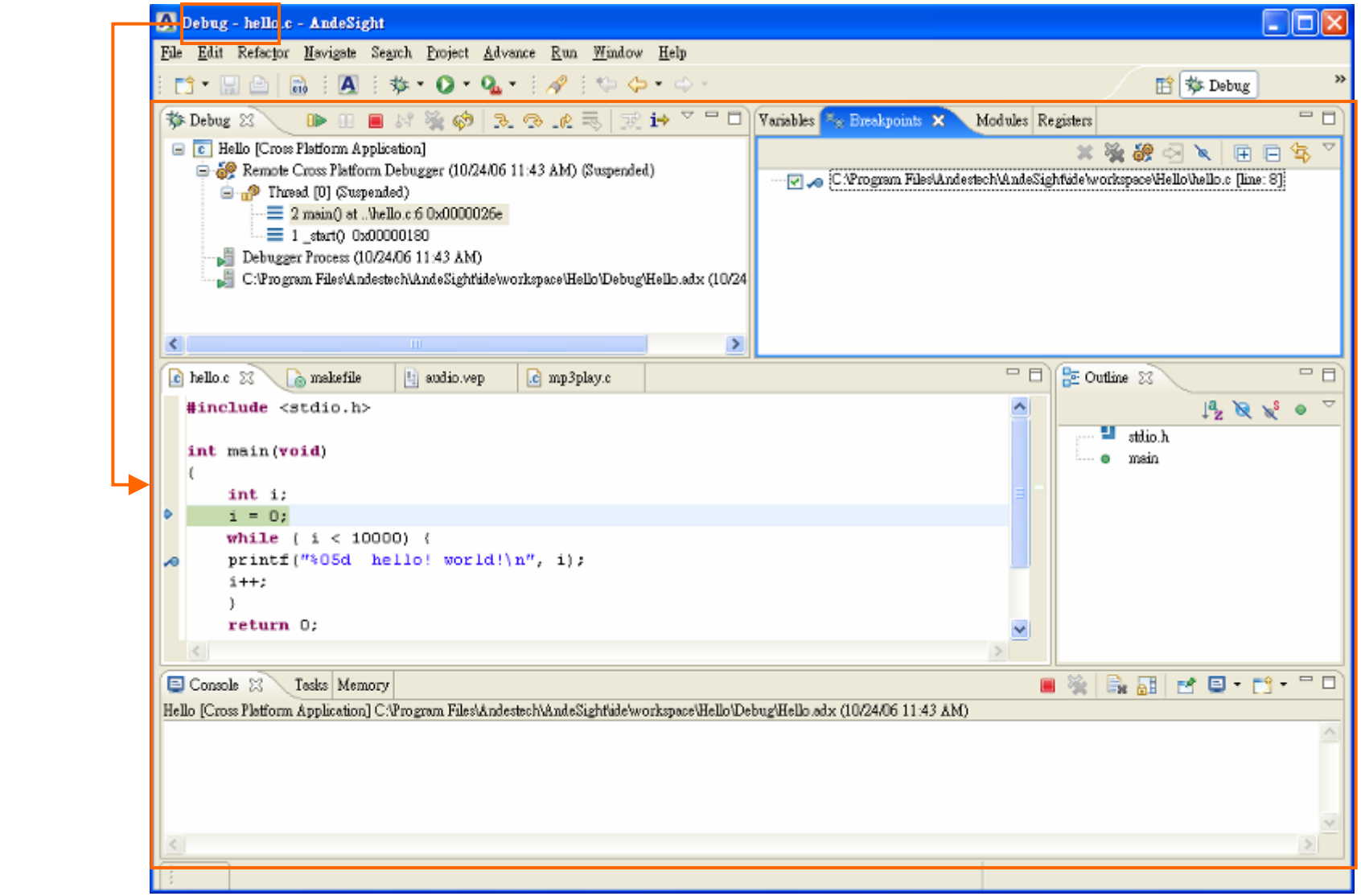
Views



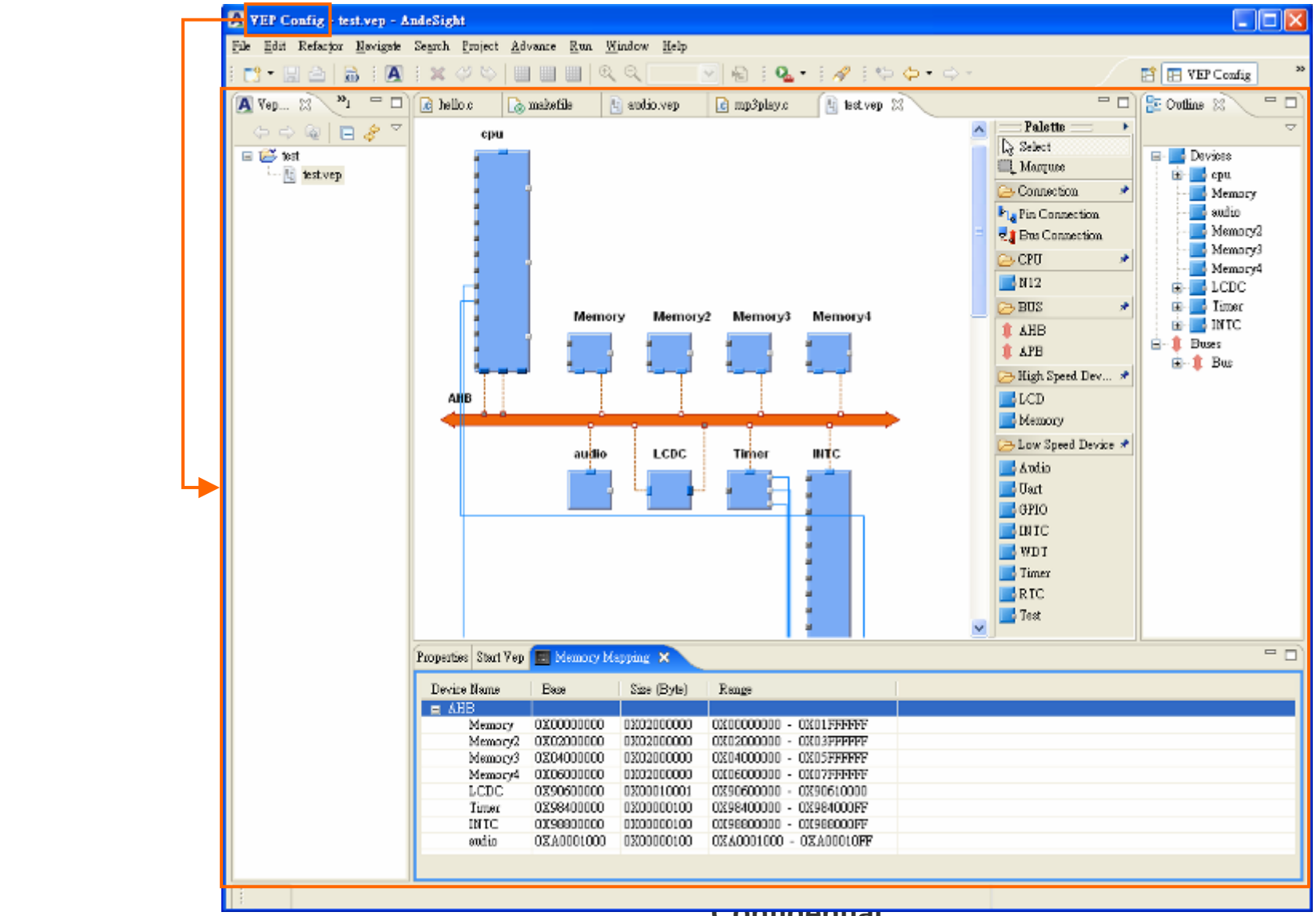
Perspectives



Perspectives - Debug



Perspectives – VEP Config



Content assistant

```
int main(int argc, char **argv)
{
    printf("hello! world!\n");

        //printf("argc=%d\n", argc);
/*
        if (argv[0])
            printf("argv[0]=%p\n", argv[0]);
        else
            printf("argv[0]=NULL\n");
*/
        func1();
        fun
    retur
}
```

- func1(void) void
- func2(void) void
- func3(void) void
- funlockfile(__sFILE64 *) void
- funopen(const void * _cookie,int (void *, char

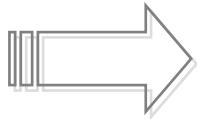
Show Function Definition

```
#include <stdio.h>

void func3(void)
{
    printf("this is %s\n", __FUNCTION__);
    //func4();
}

void func2(void)
{
    printf("this is %s\n", __FUNCTION__);
    func3();
}
voi
{
    printf("this is %s\n", __FUNCTION__);
```

```
void func3(void)
{
    printf("this is %s\n", __FUNCTION__);
    //func4();
}
```

Text Auto Completion

```
int main(int argc, char **argv)
{
   printf("hello! world!\n");

      //printf("argc=%d\n", argc);
/*
      if (argv[0])
         printf("argv[0]=%p\n", argv[0]);
      else
         printf("argv[0]=NULL\n");
*/
      func1();
      func4_
   return 0;
}
```



```
int main(int argc, char **argv)
{
   printf("hello! world!\n");

      //printf("argc=%d\n", argc);
/*
      if (argv[0])
         printf("argv[0]=%p\n", argv[0]);
      else
         printf("argv[0]=NULL\n");
*/
      func1(int val
      func4_ABC_DEF()
   return 0;
}
```

Template Support

```
#include <stdio.h>
extern int add();
int main(int argc , char **argv)
{
    int ret = 0;
    printf("Hello C !\n");
    ret = add(2 , 3);
    printf("ret:%d\n",ret);
    return 0;
    for
}
```

for - for loop
for - for loop with temporary variable

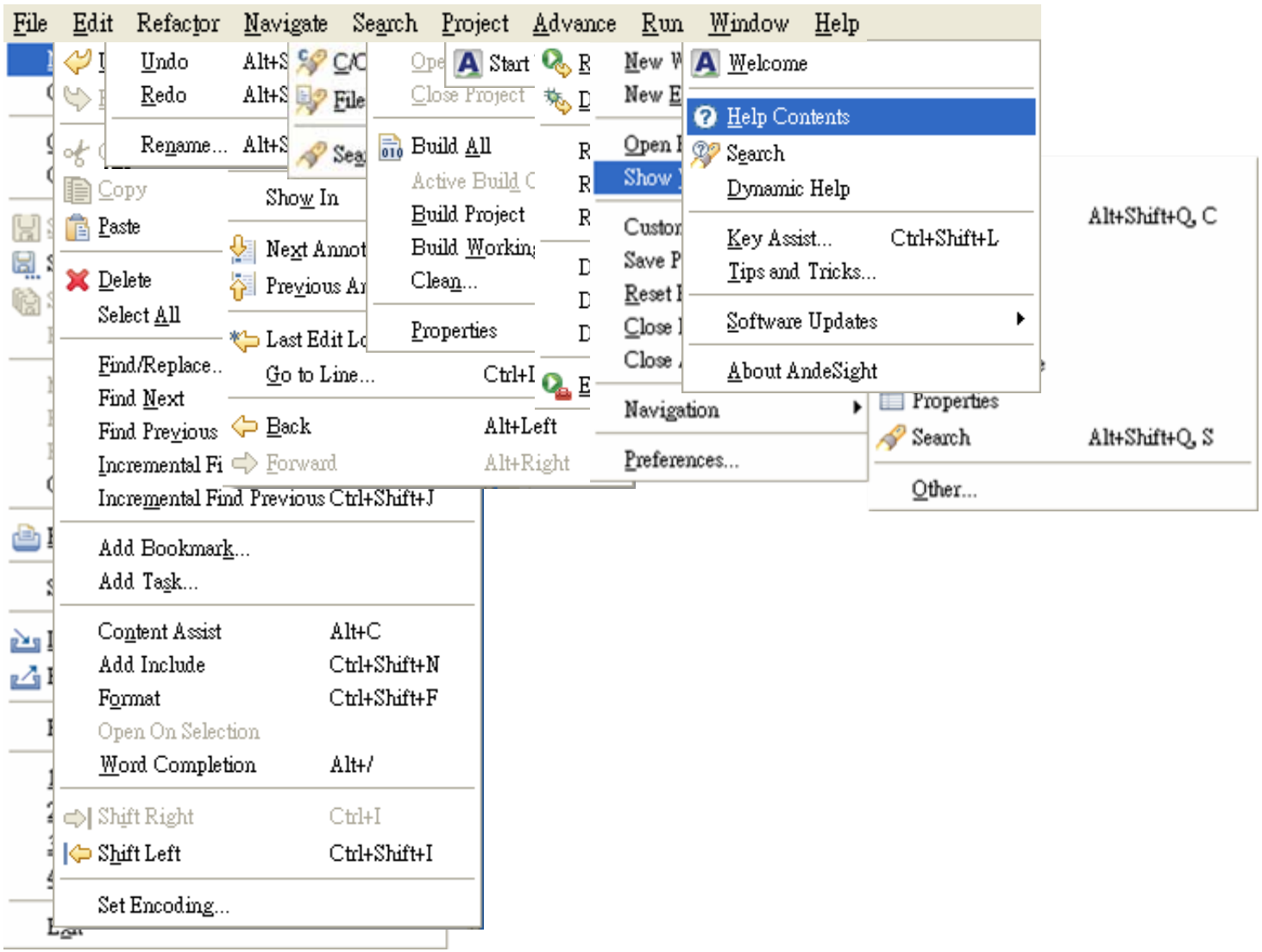
```
for (var = 0; var < max; ++var) {

    }
```

Formatter

```
int main(void)
{
    int i;
    i = 0;
    while ( i < 100 ) {
    printf("%05d  hello! world!\n", i);
    i++;
    }
    return 0;
}
```

```
int main(void)
{
    int i;
    i = 0;
    while ( i < 100 )
    {
        printf("%05d  hello! world!\n", i);
        i++;
    }
    return 0;
}
```

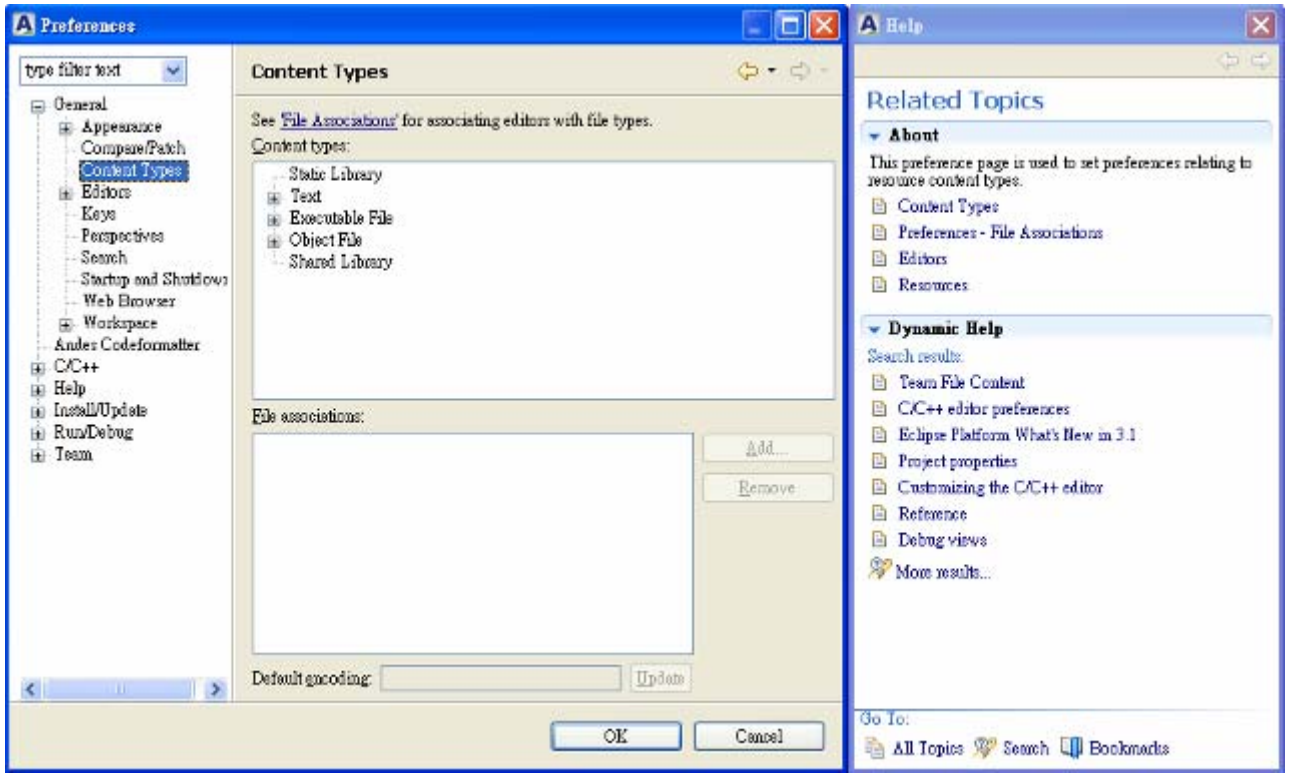
Commands and Functions



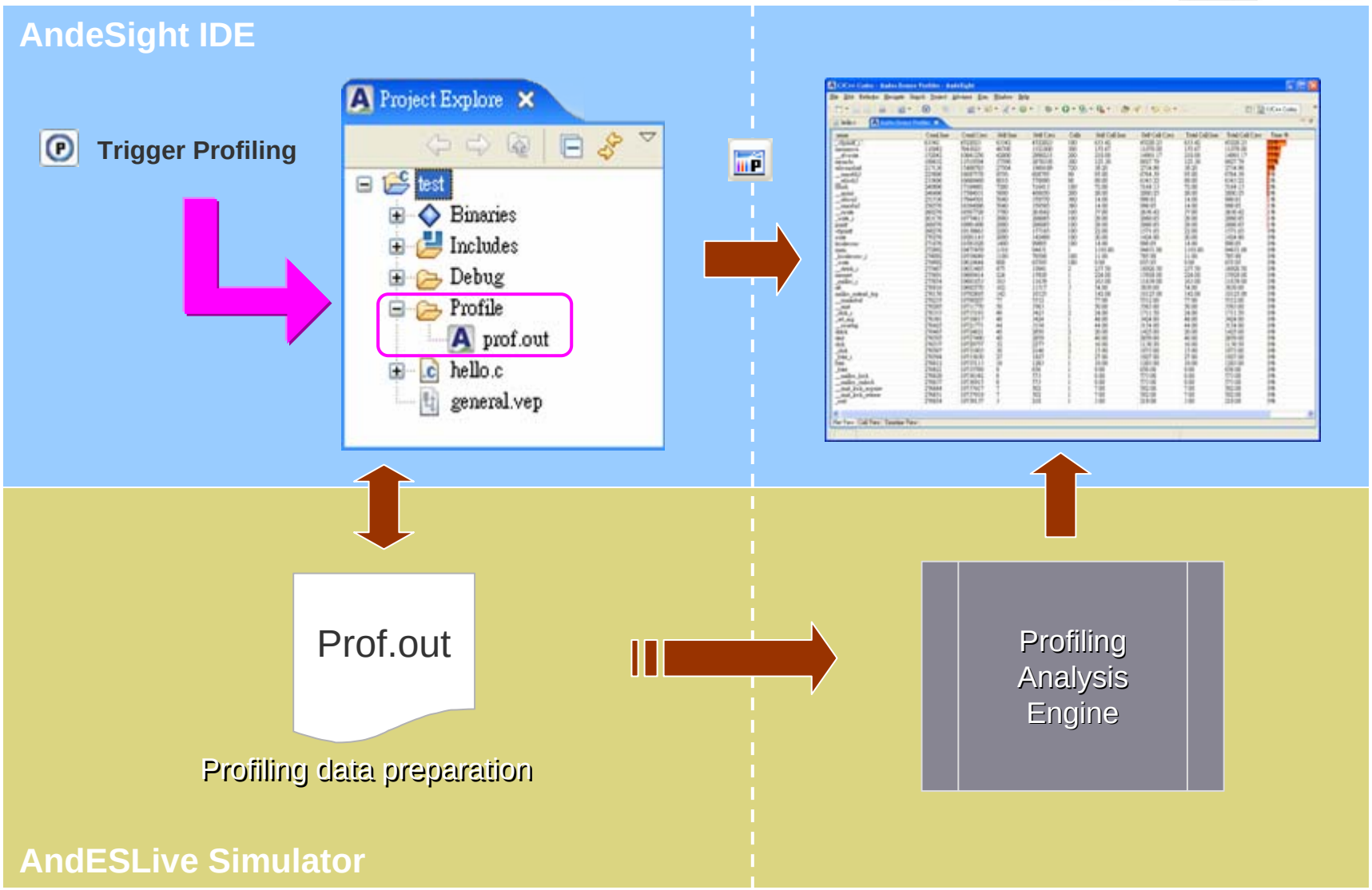
ANDES TECHNOLOGY

Help System

- Context sensitive help
  - Hot key: F1
- Help Content
- Search …



Profiling



Profiling – Timeline View

Profiler - Andes Source Profiler - AndeSight

File Edit Refactor Navigate Search Project Advance Run Window Help

Profiler

hello.c | Andes Source Profiler

Name	Parent	Instruction Count	Cycle Count	Source Location	Source Line Num
_start	<locore>	0	0	crt0.s	32
_memset	_start	19	1356	memset.c	47
_memset	_start	243	17285	memset.c	47
__set_arg	_start	255	18144	crt1.c	24
_strtok	__set_arg	271	19285	strtok.c	97
___strtok_r	_strtok	284	20213	strtok_r.c	38
___strtok_r	_strtok	737	52481	strtok_r.c	38
_strtok	__set_arg	744	52978	strtok.c	97
_strtok	__set_arg	765	54474	strtok.c	97
___strtok_r	_strtok	778	55402	strtok_r.c	38
___strtok_r	_strtok	800	56975	strtok_r.c	38
_strtok	__set_arg	807	57472	strtok.c	97
__set_arg	_start	818	58259	crt1.c	24
_main	_start	823	58614	hello.c	4
_printf	_main	838	59684	printf.c	64
_vfprintf	_printf	858	61109	vfprintf.c	385
__vfprintf_r	_vfprintf	871	62037	vfprintf.c	397
_localeconv	__vfprintf_r	882	62823	locale.c	297
__localeconv_r	_localeconv	889	63325	locale.c	280
__localeconv_r	_localeconv	900	64111	locale.c	280
_localeconv	__vfprintf_r	907	64608	locale.c	297
___sinit	__vfprintf_r	929	66170	findfp.c	165
___sinit_lock_acquire	___sinit	935	66601	findfp.c	225
___sinit_lock_acquire	___sinit	942	67103	findfp.c	225
_std	___sinit	968	68957	findfp.c	35
_std	___sinit	1022	72796	findfp.c	35
_std	___sinit	1028	73222	findfp.c	35
_std	___sinit	1082	77061	findfp.c	35
_std	___sinit	1088	77487	findfp.c	35
_std	___sinit	1142	81326	findfp.c	35
___sinit_lock_release	___sinit	1143	81397	findfp.c	231
___sinit_lock_release	___sinit	1150	81899	findfp.c	231
___sinit	__vfprintf_r	1155	82254	findfp.c	165
___swsetup	__vfprintf_r	1166	83035	wsetup.c	34

Flat View | Call View | Timeline View

ANDES TECHNOLOGY

Profiling – Call View

Profiler - Andes Source Profiler - AndeSight

File Edit Refactor Navigate Search Project Advance Run Window Help

Profiler

hello.c | Andes Source Profiler

Name	Self Insc	Self Cycc	Children Insc	Children C...	Called	Time Percentage
_vfprintf_r	63342	4522023	0	0	100	22%
Parent						
vfprintf	63342	4522023	0	0	100/100	
Child						
_sprint	5600	400050	0	0	200/200	
localeconv	1400	99885	0	0	100/100	
__umoddi3	8550	608795	0	0	90/90	
__udivdi3	8010	570890	0	0	90/90	
__sinit	50	3563	0	0	1/1	
__swsetup	44	3154	0	0	1/1	
memmove	46700	3321000	0	0	300	16%
Parent						
__sfvwrite	46700	3321000	0	0	300/300	
Child						
__sfvwrite	42000	2998233	0	0	200	15%
memchr	37590	2678338	0	0	300	13%
udivmodsi4	27504	1969189	0	0	720	9%
__umoddi3	8550	608795	0	0	90	3%
__udivdi3	8010	570890	0	0	90	2%
fflush	7200	516413	0	0	100	2%
__sprint	5600	400050	0	0	200	2%
__udivsi3	5040	359570	0	0	360	1%
__umodsi3	5040	359585	0	0	360	1%
__swrite	3700	263642	0	0	100	1%
_write_r	2900	206885	0	0	100	1%
printf	2900	206885	0	0	100	1%
vfprintf	2200	157165	0	0	100	0%
write	2000	142480	0	0	100	0%
localeconv	1400	99885	0	0	100	0%
main	1316	94431	0	0	1	0%
_localeconv_r	1100	78590	0	0	100	0%
_write	900	65595	0	0	100	0%
__strtok_r	475	33841	0	0	2	0%
memset	224	15929	0	0	1	0%
_malloc_r	163	11639	0	0	1	0%
std	162	11517	0	0	3	0%
malloc_extend_top	142	10125	0	0	1	0%
__smakebuf	77	5512	0	0	1	0%

Flat View | Call View | Timeline View

Profiling – Flat View

C/C++ Coder - Andes Source Profiler - AndeSight

File Edit Refactor Navigate Search Project Advance Run Window Help

C/C++ Coder

hello.c | Andes Source Profiler

name	Cuml Insc	Cuml Cycc	Self Insc	Self Cycc	Calls	Self Call Insc	Self Call Cycc	Total Call Insc	Total Call Cycc	Time %
_vfprintf_r	63342	4522023	63342	4522023	100	633.42	45220.23	633.42	45220.23	22%
memmove	110042	7843023	46700	3321000	300	155.67	11070.00	155.67	11070.00	16%
__sfvwrite	152042	10841256	42000	2998233	200	210.00	14991.17	210.00	14991.17	15%
memchr	189632	13519594	37590	2678338	300	125.30	8927.79	125.30	8927.79	13%
udivmodsi4	217136	15488783	27504	1969189	720	38.20	2734.98	38.20	2734.98	9%
__umoddi3	225686	16097578	8550	608795	90	95.00	6764.39	95.00	6764.39	3%
__udivdi3	233696	16668468	8010	570890	90	89.00	6343.22	89.00	6343.22	2%
fflush	240896	17184881	7200	516413	100	72.00	5164.13	72.00	5164.13	2%
__sprint	246496	17584931	5600	400050	200	28.00	2000.25	28.00	2000.25	2%
__udivsi3	251536	17944501	5040	359570	360	14.00	998.81	14.00	998.81	1%
__umodsi3	256576	18304086	5040	359585	360	14.00	998.85	14.00	998.85	1%
__swrite	260276	18567728	3700	263642	100	37.00	2636.42	37.00	2636.42	1%
_write_r	263176	18774613	2900	206885	100	29.00	2068.85	29.00	2068.85	1%
printf	266076	18981498	2900	206885	100	29.00	2068.85	29.00	2068.85	1%
vfprintf	268276	19138663	2200	157165	100	22.00	1571.65	22.00	1571.65	0%
write	270276	19281143	2000	142480	100	20.00	1424.80	20.00	1424.80	0%
localeconv	271676	19381028	1400	99885	100	14.00	998.85	14.00	998.85	0%
main	272992	19475459	1316	94431	1	1316.00	94431.00	1316.00	94431.00	0%
_localeconv_r	274092	19554049	1100	78590	100	11.00	785.90	11.00	785.90	0%
_write	274992	19619644	900	65595	100	9.00	655.95	9.00	655.95	0%
__strtok_r	275467	19653485	475	33841	2	237.50	16920.50	237.50	16920.50	0%
memset	275691	19669414	224	15929	1	224.00	15929.00	224.00	15929.00	0%
_malloc_r	275854	19681053	163	11639	1	163.00	11639.00	163.00	11639.00	0%
stdi	276016	19692570	162	11517	3	54.00	3839.00	54.00	3839.00	0%
malloc_extend_top	276158	19702695	142	10125	1	142.00	10125.00	142.00	10125.00	0%
__smakebuf	276235	19708207	77	5512	1	77.00	5512.00	77.00	5512.00	0%
__sinit	276285	19711770	50	3563	1	50.00	3563.00	50.00	3563.00	0%
_sbrk_r	276333	19715193	48	3423	2	24.00	1711.50	24.00	1711.50	0%
_set_arg	276381	19718617	48	3424	1	48.00	3424.00	48.00	3424.00	0%
__swsetup	276425	19721771	44	3154	1	44.00	3154.00	44.00	3154.00	0%
strtok	276465	19724621	40	2850	2	20.00	1425.00	20.00	1425.00	0%
start	276505	19727480	40	2859	1	40.00	2859.00	40.00	2859.00	0%
sbrk	276537	19729757	32	2277	2	16.00	1138.50	16.00	1138.50	0%
_sbrk	276567	19731903	30	2146	2	15.00	1073.00	15.00	1073.00	0%
_fstat_r	276594	19733830	27	1927	1	27.00	1927.00	27.00	1927.00	0%
fstat	276612	19735113	18	1283	1	18.00	1283.00	18.00	1283.00	0%
_fstat	276621	19735769	9	656	1	9.00	656.00	9.00	656.00	0%
__malloc_lock	276629	19736342	8	573	1	8.00	573.00	8.00	573.00	0%
__malloc_unlock	276637	19736915	8	573	1	8.00	573.00	8.00	573.00	0%
__sinit_lock_acquire	276644	19737417	7	502	1	7.00	502.00	7.00	502.00	0%
__sinit_lock_release	276651	19737919	7	502	1	7.00	502.00	7.00	502.00	0%
_exit	276654	19738137	3	218	1	3.00	218.00	3.00	218.00	0%

Flat View | Call View | Timeline View

Support and Contact

- Email
  - Sales dzhsieh@andestech.com.tw
  - IPSS
    - hfchou@andestech.com
    - IPS@andestech.com

Thank You