Pan: *High Level Description Language*

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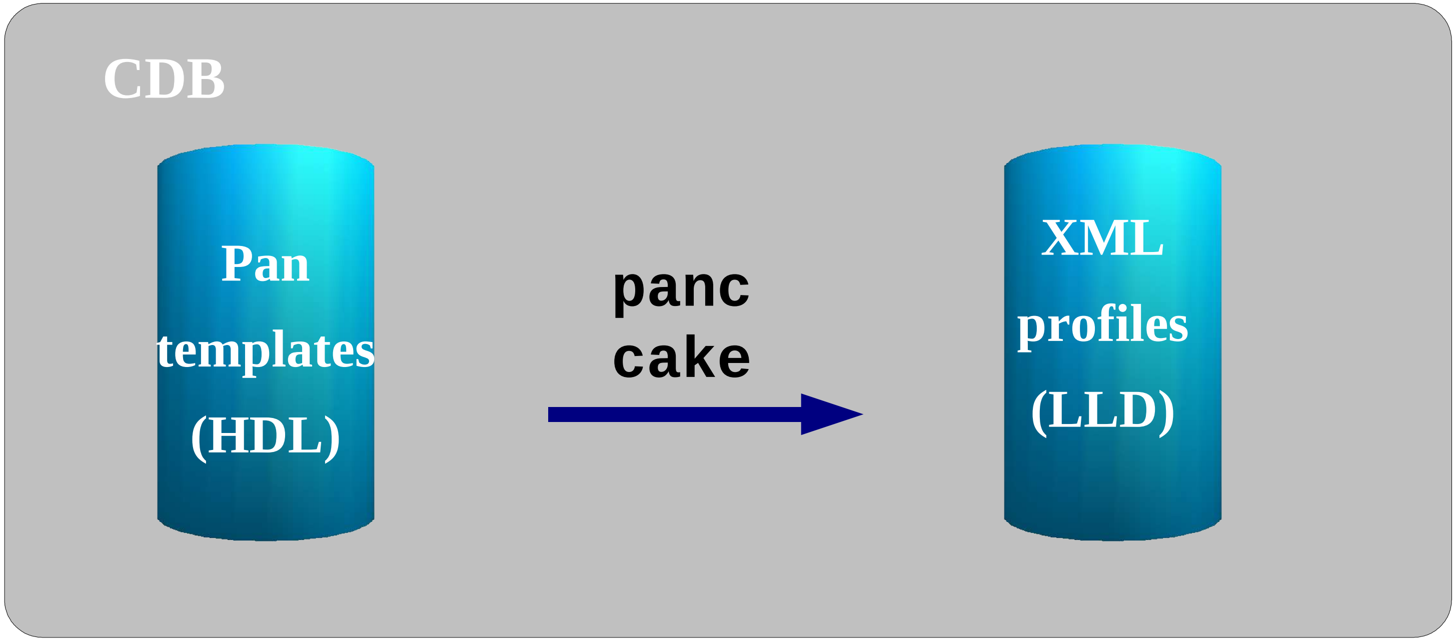
1.1 CDB and Pan

- Profiles:
  - Configuration elements for clients
  - There is a profile on CDB for each client to configure
  - Profiles are writen in pan language



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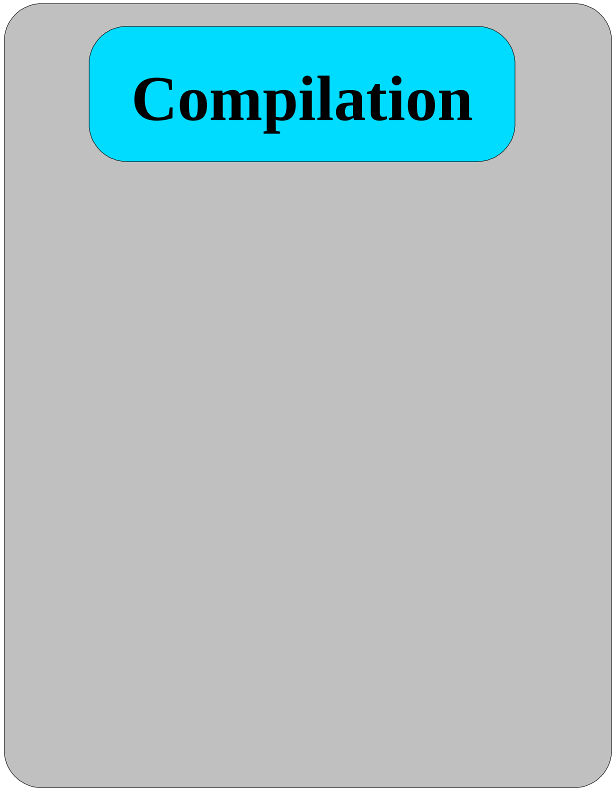
1.2 How the panc compiler works

```
panc -x compact profile.tpl
```



Compilation

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1.2 How the panc compiler works

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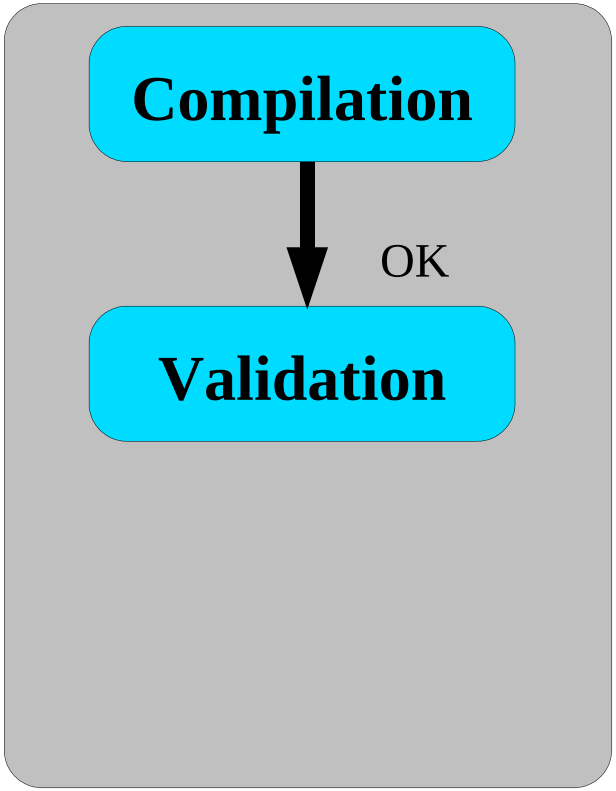

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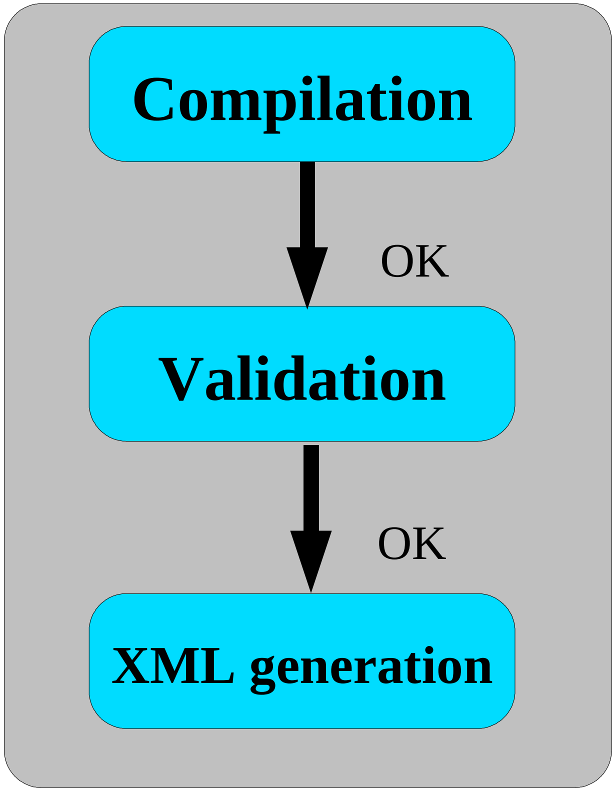
1.2 How the panc compiler works

```
panc -x compact profile.tpl
```



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1.3 Pan language characteristics

- Declarative programming language
  - plus data manipulation language
- High level abstraction
- Hierachical organization of information
- Strong type checking

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1.4 How to organize cofiguration information

- Configuration information is represented by a tree of *elements*:
  - Property (strings, numbers, ...)
  - Resource (list,nlist)
- Every element has unique *path* which identifies its position in tree

Property

/profile/network/interfaces/eth0/ip

Relative path

interfaces/eth0/ip

Resource

/profile/network/interfaces/eth0

/profile/network/interfaces

/profile/network

/profile

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1.4 How to organize cofiguration information

- Configuration information is represented by a tree of *elements*:
  - Property (strings, numbers, ...)
  - Resource (list,nlist)
- Every element has unique *path* which identifies its position in tree

Example of nlist (interfaces):

```
“/profile/network/interfaces/eth0/ip“ = “150.244.10.200“
“/profile/network/interfaces/eth0/gateway“ = “150.244.10.1“
“/profile/network/interfaces/eth0/netmask“ = “255.255.255.0“

“/profile/network/interfaces/eth1/ip“ = “192.168.0.100“
“/profile/network/interfaces/eth1/gateway“ = “192.168.0.1“
“/profile/network/interfaces/eth1/netmask“ = “255.255.255.0“
```

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1.4 How to organize cofiguration information

- Configuration information is represented by a tree of *elements*:
  - Property (strings, numbers, ...)
  - Resource (list,nlist)
- Every element has unique *path* which identifies its position in tree

Example of list (RAM):

“/profile/hardware/ram/0/type“ = “DDR“

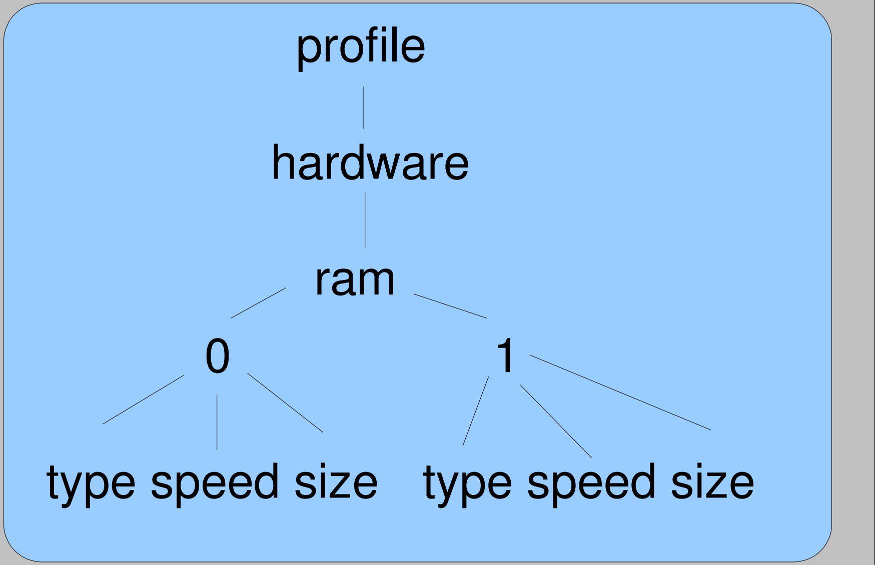
“/profile/hardware/ram/0/speed“ = 133

“/profile/hardware/ram/0/size“ = 256

“/profile/hardware/ram/1/type“ = “DDR“

“/profile/hardware/ram/1/speed“ = 133

“/profile/hardware/ram/1/size“ = 256



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3. Exercises

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2.1 Templates and Statements (1 / 2)

- Main pan statements
  - Include:
    - `include identifier ';'`
  - Assignement:
    - `path '=' dml ';' # where` *`path`* `is a string`
  - delete:
    - `delete path ';'`

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2.1 Templates and Statements (2 / 2)

- Statements are grouped into templates

Structure template

```
structure template ram;
  "type" = "DDR";
  "speed" = 133;
  "size" = undef;
```

Declaration template

```
declaration template types;
  define type ram_type = {
    "type"  : string
    "speed" : long
    "size"  : long
  };
```

Ordinary template

```
template hardware;
  "/hardware/ram/0" = create ("ram");
  "/hardware/ram/1" = create ("ram");
```

Object template

```
object template lxplus001;
  include types;
  type "/" = root_type;
  include hardware;
  "/hardware/ram/0/size" = 128;
  "/hardware/ram/1/size" = 128;
  "/hardware/total_mem" = 256;
```

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2.2 Pan source files

- Pan Source Files
  - Filename should match template name
  - Source files end with “.tpl“
- Pan source files can include comments preceded by “#“

```
“/hardware/ram/0“ = create (“ram“) ;  # First RAM module
```

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2.3 Types checking

- Pan has a strong type checking, it is not allowed to mix different data types

```
    “/x“ = 1 ;       # it is long
    “/x“ = “1“ ;     # Error: String to long
```

- We can add restrictions to any subtree

```
# restriction: swap size must be twice memory size
define type system_type = {
    "swap_size" : long with {
       self == (2* value("/hardware/total_mem"))}
};
```

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2.4 Basic data types and variables

- Variables
  - There is no need to declare them
- Global Variables
  - They cannot be redifined

object, **self**

```
"swap_size" : long with {
    self == (2* value("/hardware/total_mem"));
```

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2.4 Basic data types and variables

- Boolean

`true` **or** `false`

- Long

```
245    0       0x20   0xdeadb       0755
```

- Double

```
0.01  3.1416       1e-8  6.034582e23
```

- String

```
'a simple string', 'a bit more \t complex one \n'
```

- Undef
  - Represents non defined elements
  - They must be defined before the create the LLD file

```
“ip“ = undef;
```

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2.5 Operators

- Arithmetic Operators

Unary: -

Binary: +, -, *, /, %

- String Operator

Binary: +

- Comparison Operators (work on strings and numbers)

Binary: <, <=, >, >=, ==, !=

- Boolean Operators

Unary: !

Binary: &&, |, ||

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2.6 Complex data types

- Alias

```
define type ulong1 = long with self >= 0;
# it is equivalent to previous one
define type ulong1= long (0..);
define type port = long (0..65535);
```

- Link

```
define type disk_link = long (8..) *
    with match (self, '^(hda|hdb)$');
type “/device“ = disk_link;
# check that device is hda or hdb
“/device“ =  “/hda“;
# check that value is >= 8
“/hda“= 20;
```

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2.6 Complex data types

- Records

```
define type network {
      “ip“: string;
      “gateway“: string;
};
```

```
# list of record
“/profile/network/interfaces/0/ip“ = “150.244.10.200“
“/profile/network/interfaces/0/gateway“ = “150.244.10.1“
“/profile/network/interfaces/1/ip“ = “192.168.0.100“
“/profile/network/interfaces/1/gateway“ = “192.168.0.1“
```

```
# nlist of records
“/profile/network/interfaces/eth0/ip“ = “150.244.10.200“
“/profile/network/interfaces/eth0/gateway“ = “150.244.10.1“
“/profile/network/interfaces/eth1/ip“ = “192.168.0.100“
“/profile/network/interfaces/eth1/gateway“ = “192.168.0.1“
```

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2.6 Complex data types

- List

```
x = string []; # shuld go to type declaration
“/dns/0“= “150.244.10.200“;
“/dns/1“= “150.244.10.100“;
x = list (“150.244.10.200“,“150.244.10.100“);
z= x[1]; # set z to “150.244.10.100“
```

- Table (nlist)

```
machines = string {}; # should go to type declaration
“/machines/test1“= “192.168.0.100“;
“/machines/test2“= “192.168.0.101“;
machines = nlist (“test1“,“192.168.0.100“ ,
                  “test2“, “192.168.0.101“);
ip1=machines[“test1“];  ip2=machines[“test2“];
```

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2.7 Flow Control

- Sequencing
- Branchig

```
if (value  (“/hardware/memory/size“) > 256) {
    swap = 512;
} else { swap = 256 };
```

- Looping

```
              i=0;
              while (i <= 9) {
                    i= i + 1; };
```

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2.8 Functions

```
define function increment = {
     if (argc==2){
           val = argv[0] + argv[1];
           return (val);
     } else { return 0 };
};

# how to call a function
i=3;
x=increment (i,2);  # x will equal to 5
```

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2.8 Functions

- **create (name: string,....) : nlist**

```
structure template mount_cdrom
      “device“ = undef;
      “path“ = “/mnt/cdrom“; };
“/system/mounts/0“ = create (“mount_cdrom“, “device“,“hdc“);
# it is equivalent to
“/system/mounts/0“ = create (“mount_cdrom“);
“/system/mounts/0/device“ = “hdc“;
```

- **list (....) : list**

```
“/system/dns“ = list (“150.244.9.200“,“150.244.9.100“);
# it is equivalent to
“/system/dns/0“ = “150.244.9.200“;
“/system/dns/1“ = “150.244.9.100“;
```

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2.8 Functions

- **value (path:string) : element**

```
 “/x“ = 100;
 “/y“ = 2 * value (“/x“); # /y será 200

“/system/dns“ = list (“150.244.9.200“,“150.244.9.100“);
  z= (value(“/system/dns/0“)
      == value(“/system/dns/1“) ) ; # z is false
 # it is equivalent to
  v= value(“/system/dns“);
  z= (v[0])  == v[1]) ; # z es false
```

- **match (arg: string, regxep : string): boolean**

```
 # device_t is a string either disk or cd
   device_t = string with match (self, ' ^(disk|cd)$');
   device_t = “cdrom“; # Error
```

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2.8 Functions

- **`first (arg:resource, key:identifier, value:identifier) : boolean`**
- **`next (arg:resource, key:identifier, value:identifier) : boolean`**

```
numlist = list (1,2,4,8);
sum =0;
ok = first (numlist,iter,v);
while (ok) {
    sum = sum + v;
    ok = next (numlist,iter,v);
};
#sum = 15
```

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For more information:

(see 'quattor web page' -> 'documentation')

- *Pan Language Specification*
  (Version 2.0.1)

- *Pan Tutorial*
  (Version 1.0.2)

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3. Exercises

1. Introduction to Pan
2. Pan Syntax
3. **Exercices**