KNX2 Compiler Chain - Update 1

https://github.com/knoxaramav2/KCC

ABOUT

General

The KNX2 Compiler Chain (KCC) will be designed to compile and assemble KNX2 programming code to machine code. The minimum expected deliverable is to be a working compiler to convert the KNX2 language to ARMx86 assembly, specifically targeted for the Raspian operating system. If time allows, a custom assembler will also be written, which is an expected outcome. As this may take a large amount of time, the third deliverable, the linker, is unexpected.

The name KNX2 comes from a current side project in developing a runtime language, although the languages will have little in common.

Example Expected Workflow and Target Operation

Written Code

Below is an example program written in the current KNX2 syntax. This includes example commands to compile the source code, and invoke with sample cli options and its output.

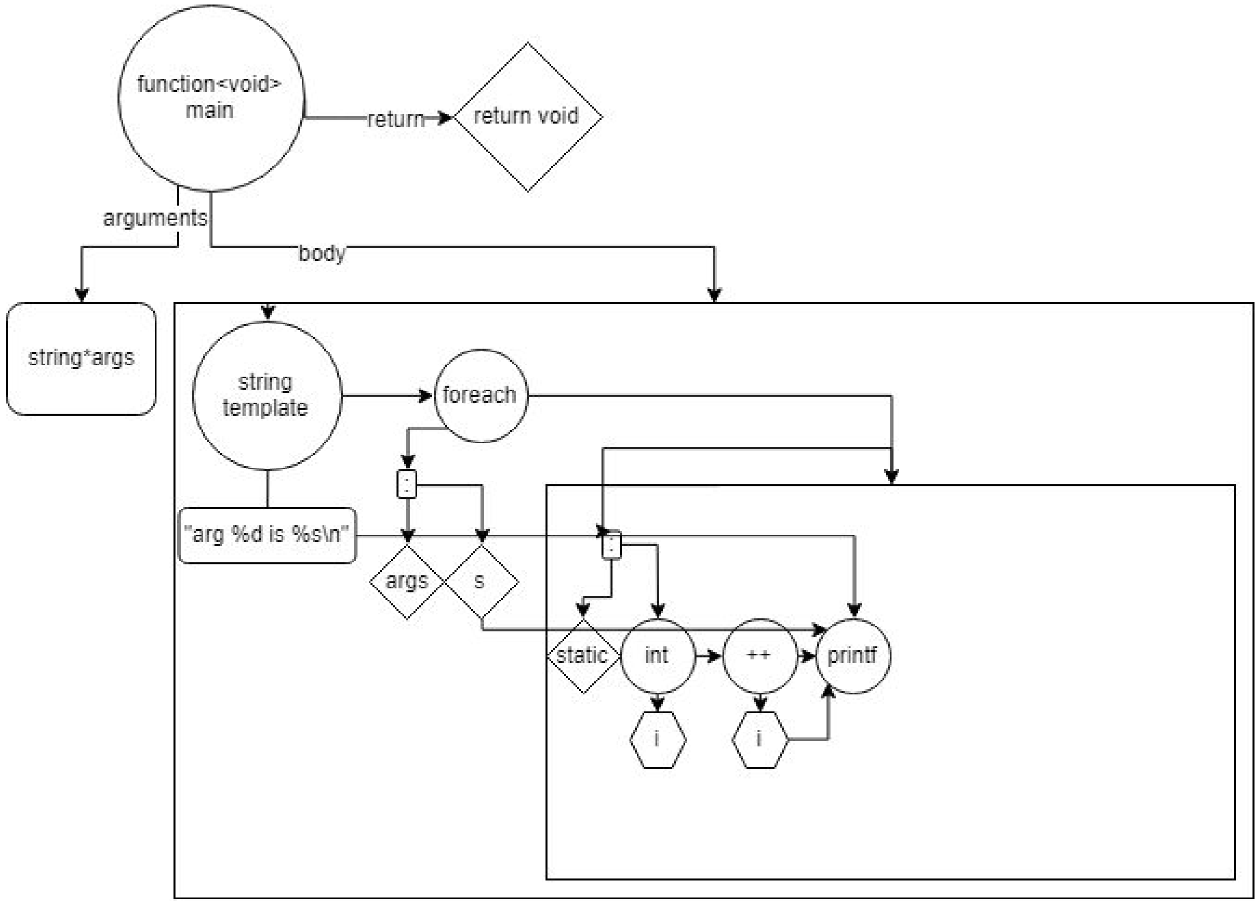
Main.k2

```
@use io             #keyboard, console io
@use common         #string/array utils

#must have a main function, does not have to be void
function<void> main(string*args, {
        string template("arg %d is %s\n");

        foreach (args:s, {
                int:static i;
                ++i;
                printf(template, i, s);
        });
});

#compile options: kcc main.k2 -o main.exe
#sample cli options: ./main.exe jerry garcia
#sample cli output:
#	arg 1 is jerry
#	arg 2 is garcia
```



Language Syntax

This section covers built-in functions and operators, as well as providing information about how these relate the Abstract Syntax Tree (AST) used to verify grammar and produce a reliable and versatile token tree for use in code analysis and generation. The language syntax is designed to be compatible with a modification to the Shunting-Yard algorithm.

Each keyword and operator has a nodal definition (defines the rules for how it fits into the AST) that specifies possible child leaf configurations. Abbreviated, these designations are as follows:

NoChild (NC): The verb accepts no arguments and acts as a standalone.
Unary (U): Accepts one argument immediately proceeding it.
BinaryLeftRight (BLR): Accepts two arguments immediately on either side.
BinaryRightRight(BRR): Accepts two arguments to the immediate right and proceeding thereafter.
BinaryChain(BC): Used in lists, consists of the pattern A1 BC A2 BC … A_{n-1} BC An. When one is found, every other token will be checked. When chain token is no longer found, all elements within the found range will be collected into a subtree and treated as an array.

Keywords
**arg denotes optional argument*

Keyword	Description	AST Relation
if(bool){}	Executes the next instruction or block if condition is non-zero. Accepts a condition (bool) and instruction.	BRR
else{}	Executed only if previous if statement fails evaluates zero. Accepts an instruction.	U
while(bool){}	Loops next instruction whilst the given argument is non-zero.	BRR
foreach(var:sym)	Accepts an array type variable (var) and iterates through each member, with each new iteration producing the local variable (sym). The local variable (sym) does not require explicit type declaration.	BRR
continue	Jump to start of closest scoped loop or switch. If used within a switch, it becomes a loop for conditions with this statement.	NC
break	Jump to end of closest scoped loop or switch.	NC
return *arg, arg,...*	Return from current function. May have zero or greater return values. Void return type is assumed if omitted.	NC/U
class *symbol* {}	Defines a custom class. Accepts a unique symbol name and body definition.	BRR
goto *tag*	Jump to a tagged point in code within the same function.	U
null	Alias for 0	NC

Operators
*_arg_ denotes optional argument

	Operator	Description	AST Relation
=	Set	Set the value of L to R	BLR
+	Sum	Sum L to R operand	BLR
-	Difference	Subtract R from L	BLR
*	Product	Multiply L and R	BLR
/	Quotient	Divide L by R	BLR
**	Power	Raise L to the R power	BLR
%	Modulo	Return the remainder of L/R (integer only)	BLR
+=	Set Sum	Set L = L+R	BLR
-=	Set Diff	Set L = L-R	BLR
*=	Set Product	Set L = L*R	BLR
/=	Set Quotient	Set L = L/R	BLR
^	Invert	Invert bits on operand.	U
&&	Logical And	Return 1 if both L and R are non-zero. Otherwise, 0.	BLR
||	Logical Or	Return 1 if either L or R are non-zero.	BLR
!	Logical Not	If immediate right is zero, return 1. Else, return 0.	U
!&	Nand	Return 1 if either L or R are non-zero.	BLR
!|	Nor	Return 1 if L and R are zero.	BLR
^|	Xor	Return 1 if exactly one of L and R are 1	BLR
^!	XNor	Return 1 if both or neither of L and R are 1 or 0 simultaneously.	BLR
&	Bitwise And	Return bitwise AND L and R	BLR
|	Bitwise Or	Return bitwise OR L and R	BLR
c++	Post Increment	Return c and then increment.	U

c--	Post Decrement	Return c and then decrement.	U
++c	Pre Increment	Increment c, and return result.	U
--c	Pre Decrement	Decrement c, and return result.	U
[*arg]	Define Array	*Type[*arg]symbol* Define *Symbol* as an array of *type*. If an integer *arg* is provided, the array is initialized at the provided size at default values. Otherwise, the array is empty.	BLR
,	List	Define a comma separated list	BC
@	Reference	Used in function argument list to accept the memory address of a parameter instead of its value. This variable will then be treated as a normal variable.	

PreProcessor Directives

All directives begin with ‘@’ without whitespace. Each directive may have at most one argument; for example ‘@use io’. These directives are executed before other code is processed, and then discarded.

Directive	Description
@use *library*	Import a library
@define *name value*	Define an alias with a value

Modifiers

Modifiers follow the pattern *Declaration:Modifier1,Modifier2,...* and are used to set attribute flags on variable or function instances.

Modifier	Description	Supported Types
static	Establishes a global function within a function namespace. Establishes a global variable shared between class instances.	Variable, Function

public	Flags a class member as externally accessible. Flags a translation unit function as externally accessible.	Variable, Function, Class
private	Flags a class member as externally hidden (default). Flags a translation unit function as externally hidden (default).	Variable, Function, Class

Data Types

Type	Keyword	Size (Bytes)	Range
Integer	int	4	-2,147,483,648 - 2,147,483,647
Short Integer	sint	2	-32,768 - 32,767
Double	real	8	-1.7E+308 to +1.7E+308
Character	char	1	-127 - 127
Byte	byte	1	0 - 255
String	string	1N	N bytes
Class	class		
Bool	bool	1	Either 0 - 255 or -127 - 127
Function	function<type>		