CCA
Common Component Architecture

Language Interoperability Using

CCA Forum Tutorial Working Group
http://www.cca-forum.org/tutorials/

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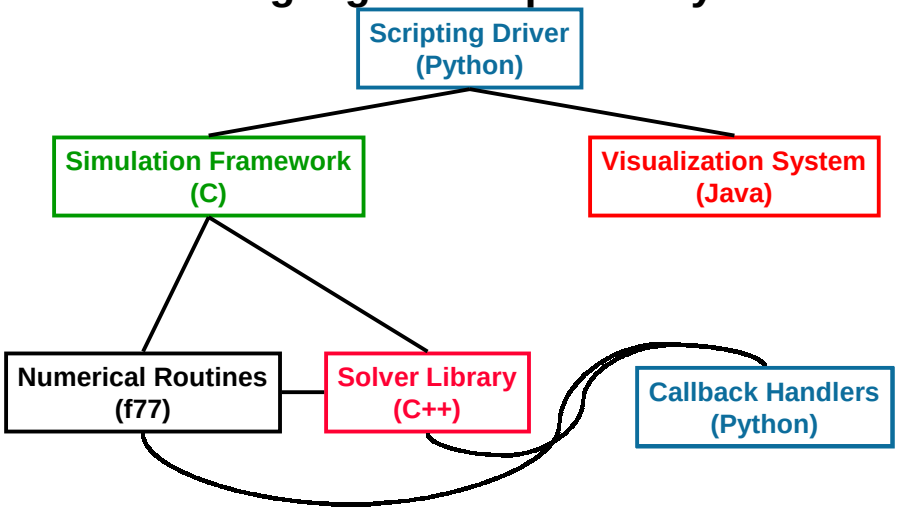
What I mean by "Language Interoperability"



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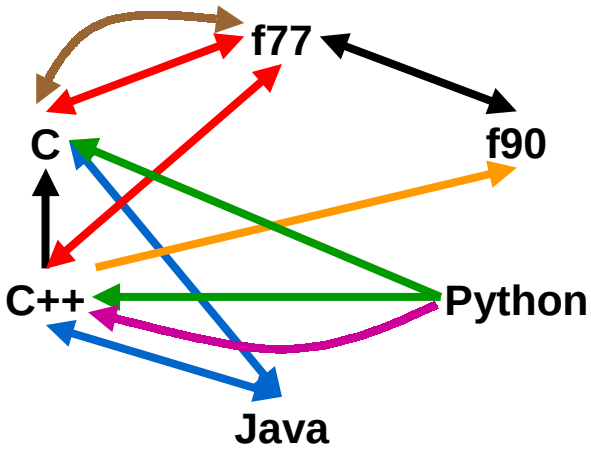
One reason why mixing languages is hard



Native

cfortran.h

SWIG

JNI

Siloon

Chasm

Platform Dependent

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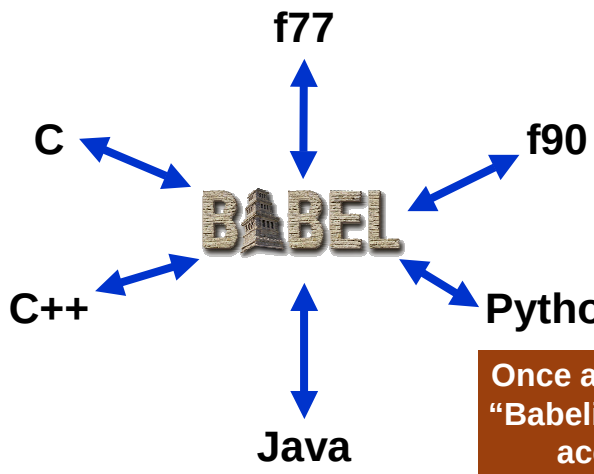
Babel makes all supported languages peers



This is not an LCD Solution!

Once a library has been "Babelized" it is equally accessable from all supported languages

CCA Common Component Architecture

Babel Module's Outline

- Introduction
- Babel Basics
  - What Babel does and how
  - How to use Babel
  - Concepts needed for future modules
- Babel & CCA
  - History & Current directions
  - Decaf Framework
  - Building language independent CCA components
  - Demo

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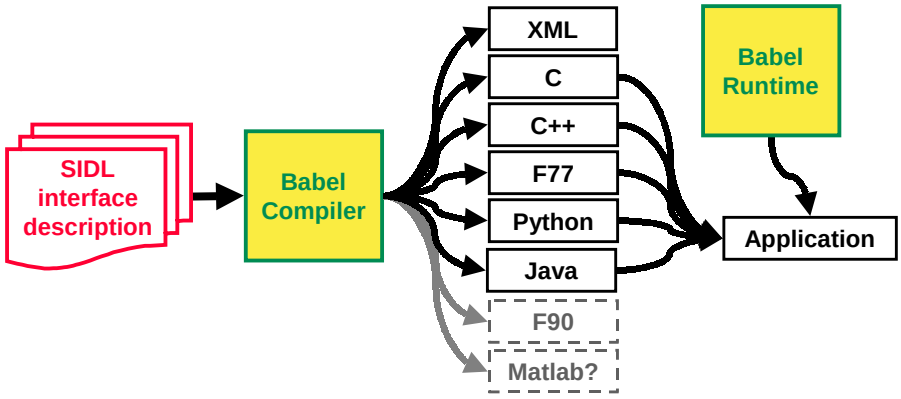
Babel's Mechanism for Mixing Languages

- Code Generator
- Runtime Library



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greetings.sidl: A Sample SIDL File

```
version greetings 1.0;
package greetings {
    interface Hello {
        void setName( in string name );
        string sayIt ( );
    }
    class English implements-all Hello {  }
}
```


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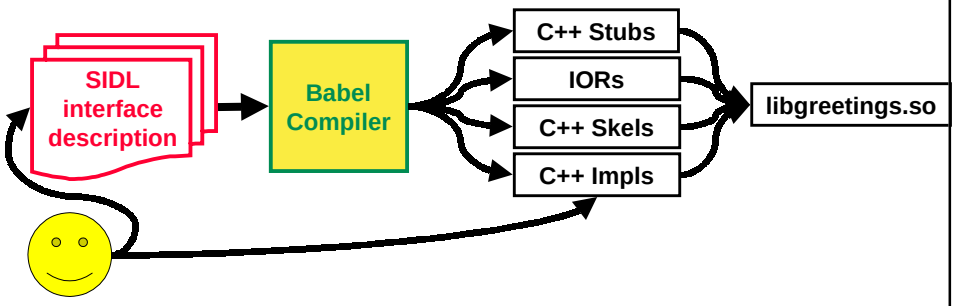
Library Developer Does This...



- `babel --server=C++ greetings.sidl`
- Add implementation details
- Compile & Link into Library/DLL

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Adding the Implementation

```
namespace greetings {
class English_impl {
  private:
    // DO-NOT-DELETE splicer.begin(greetings.English._impl)
    string d_name;
    // DO-NOT-DELETE splicer.end(greetings.English._impl)
```

```
string
greetings::English_impl::sayIt()
throw ()
{
  // DO-NOT-DELETE splicer.begin(greetings.English.sayIt)
  string msg("Hello ");
  return msg + d_name + "!";
  // DO-NOT-DELETE splicer.end(greetings.English.sayIt)
}
```


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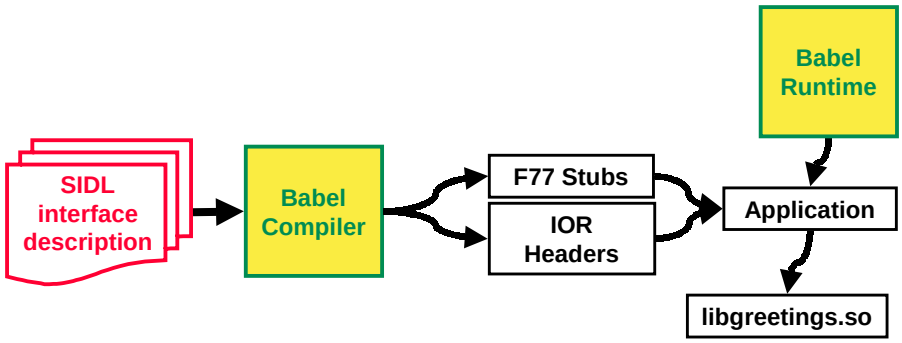
Library User Does This...



- `babel --client=F77 greetings.sidl`
- Compile & Link generated Code & Runtime
- Place DLL in suitable location

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Babel Module's Outline

- Introduction
- Babel Basics
  - What Babel does and how
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  - History & Current directions
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  - Building language independent CCA components
  - Demo

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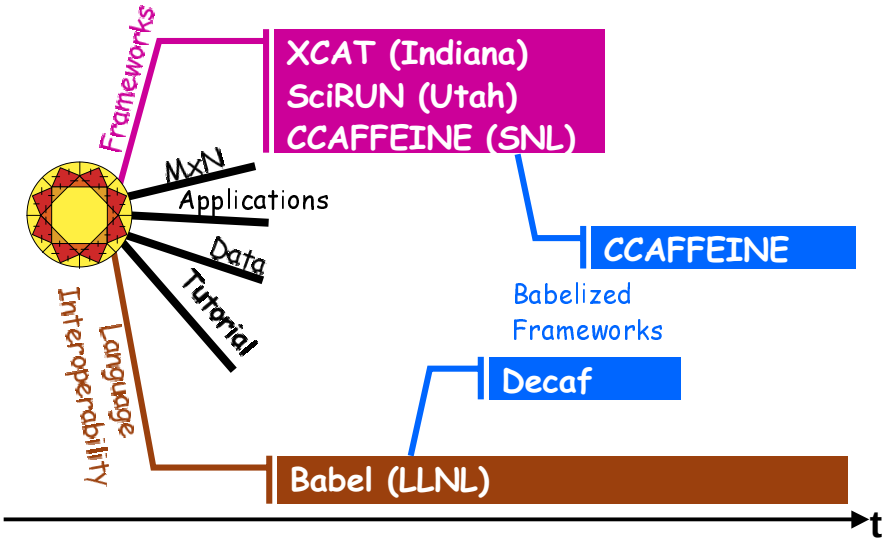
History of Babel & CCA



Decaf Details & Disclaimers

- Babel is a hardened tool
- Decaf is an example, not a product
  - Demonstrate Babel's readiness for "real" CCA frameworks
  - Maintained as a stopgap
  - Distributed in "examples" subdirectory of Babel
- Decaf has no GUI

The CCA Spec is a SIDL File

```
version cca 0.6;
package cca {
    interface Port { }
    interface Component {
        void setServices( in Services svcs );
    }
    interface Services {
        Port getPort( in string portName );
        registerUsesPort( /*etc*/ );
        addProvidesPort( /*etc*/ );
    /*etc*/
```

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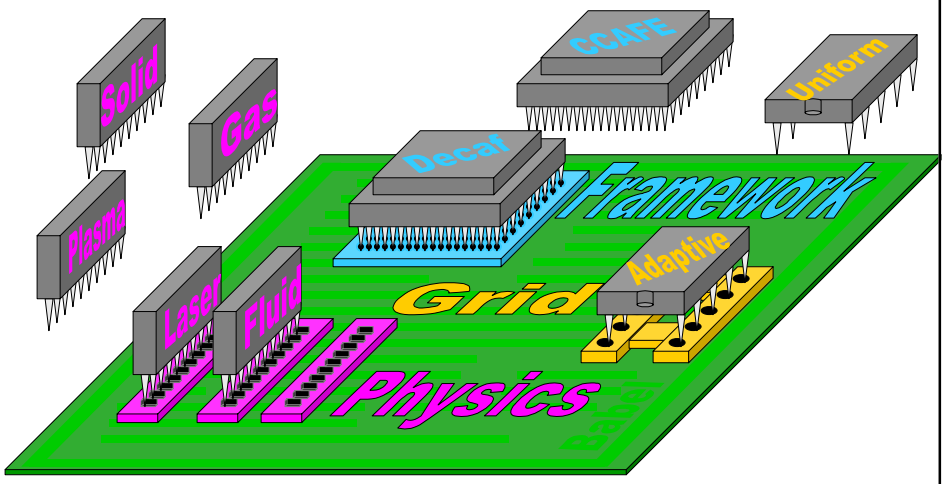
The CCA from Babel's POV



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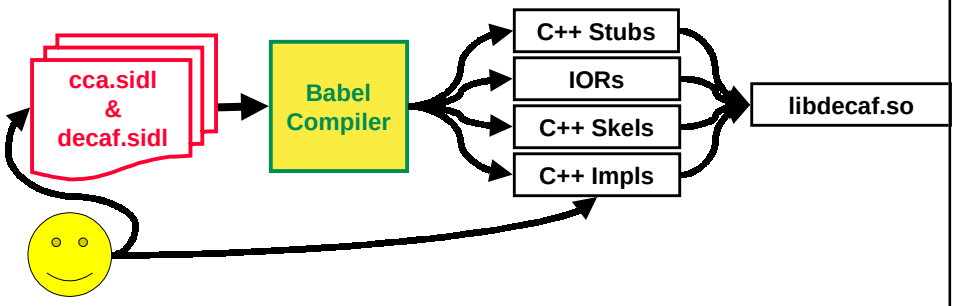
How I Implemented Decaf



- wrote decaf.sidl file
- `babel --server=C++ cca.sidl decaf.sidl`
- Add implementation details
- Compile & Link into Library/DLL

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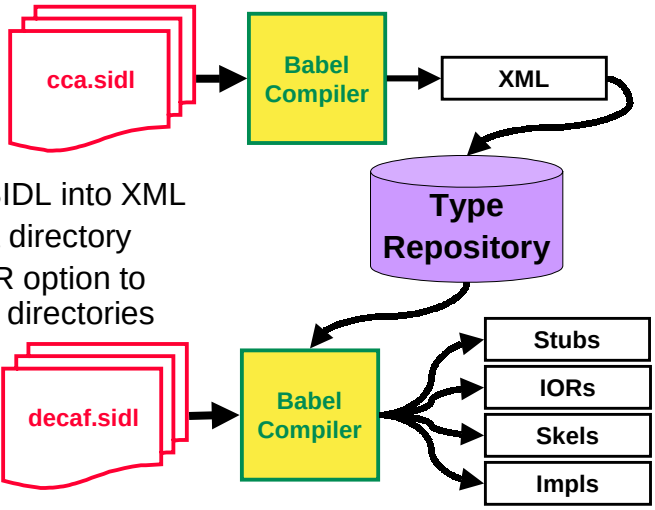
An Extra Babel Tip



- "precompile" SIDL into XML
- store XML in a directory
- Use Babel's –R option to specify search directories

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How to Use CCA Components and Decaf

- Decaf doesn't provide a GUI
- Simply program by explicitly
  - creating components
  - connecting points
  - envoking the "goPort"
- Use Babel as needed to generate bindings in your language of choice
- Make sure Babel Runtime can locate DLLs for Decaf and any CCA components.

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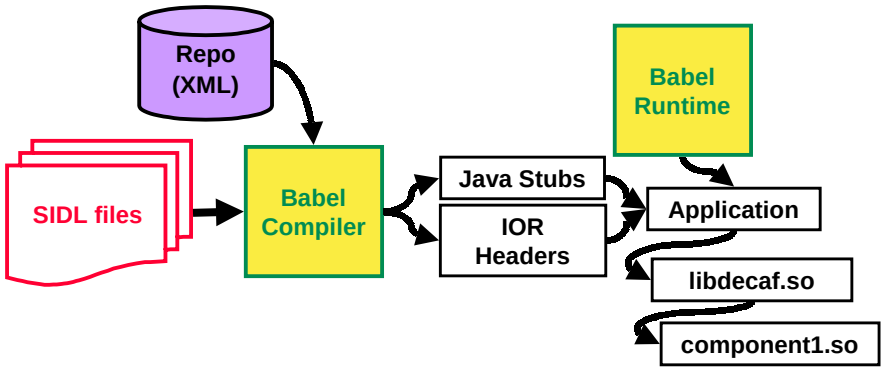
To Use the Decaf Framework



- `babel --client=Java –Rrepo function.sidl`
- Compile & Link generated Code & Runtime
- Place DLLs in suitable location

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Example: A Driver in Python

```
import decaf.Framework
import cca.ports.GoPort
if __name__ == '__main__':
  decaf = decaf.Framework.Framework()

  server = decaf.createInstance( "ServerName",
           "HelloServer.Component", 0 )
  client = decaf.createInstance( "ClientName",
           "HelloClient.Component", 0 )

  decaf.connect(server,"HelloPort",
                client,"HelloPort" )

  port = decaf.lookupPort(client,"GoPort")
  go = cca.ports.GoPort.GoPort( port )
  go.go()
```

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How to Write and Use Babelized CCA Components

- Define “Ports” in SIDL
- Define “Components” that implement those Ports, again in SIDL
- Use Babel to generate the glue-code
- Write the guts of your component(s)

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SIDL 101: Classes & Interfaces

- SIDL has 3 user-defined objects
  - Interfaces – APIs only, No Implementation
  - Abstract Classes – 1+ methods unimplemented
  - Concrete Classes – All methods are implemented
- Inheritance (like Java/Objective C)
  - Interfaces may extend Interfaces
  - Classes extend no more than one Class
  - Classes can implement multiple Interfaces
- Only Concrete Classes can be Instantiated

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SIDL 101: Methods and Arguments

- Methods are public virtual by default
  - static methods are not associated with an object instance
  - final methods can not be overridden
- Arguments have 3 parts
  - Mode: can be in, out, or inout (like CORBA)
  - Type: one of (bool, char, int, long, float, double, fcomplex, dcomplex, array<Type,Dimension>, enum, interface, class)
  - Name:

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How to Write A Babelized CCA Component (1/3)

- Define “Ports” in SIDL
  - CCA Port =
    - a SIDL Interface
    - extends cca.Port

```
version tutorial 1.0;

package tutorial {
    interface Function extends cca.Port {
        double evaluate( in double x );
    }
}
```

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How to Write A Babelized CCA Component (2/3)

- Define “Components” that implement those Ports
  - CCA Component =
    - SIDL Class
    - implements cca.Component (& any provided ports)

```
class LinearFunction implements tutorial.Function,
                                cca.Component {
      double evaluate( in double x );
      void setServices( in cca.Services svcs );
}
```

```
class LinearFunction implements-all
       tutorial.Function, cca.Component { }
```


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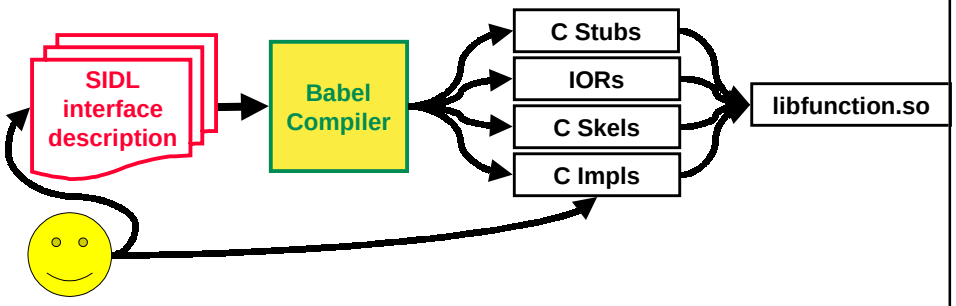
How to Write A Babelized CCA Component (3/3)



- Use Babel to generate the glue code
  - `babel --server=C –Rrepo function.sidl`
- Add implementation Details