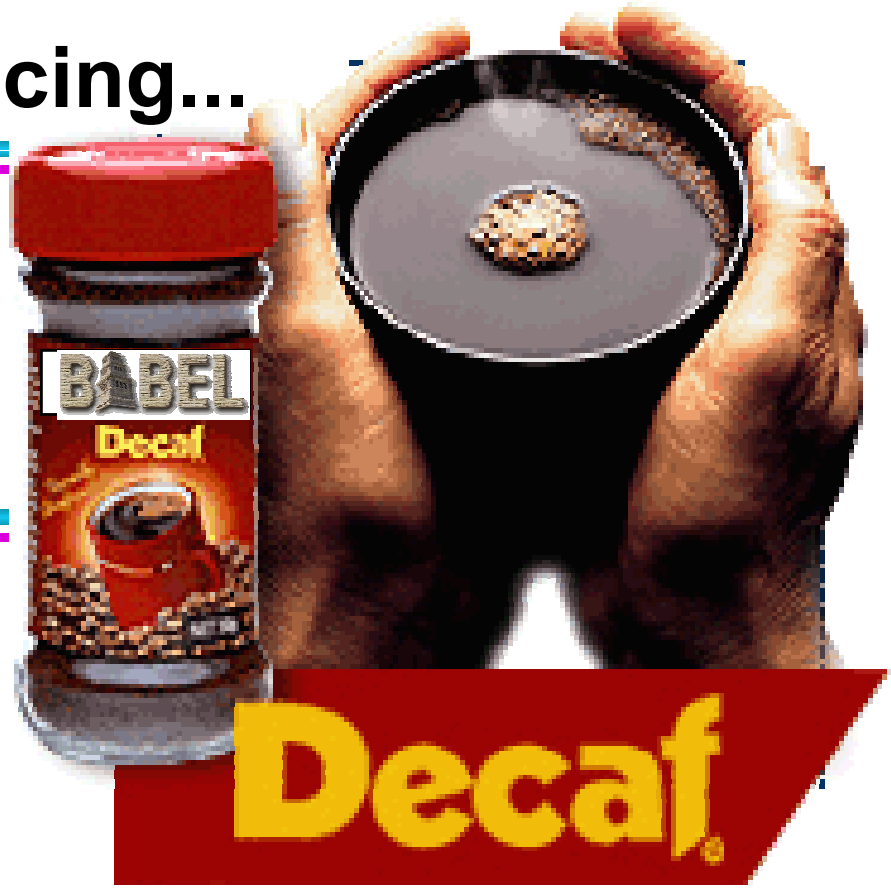
Introducing...



Gary Kumfert & Scott Kohn
Tammy Dahlgren, Tom Epperly,
Steve Smith, and Bill Bosl

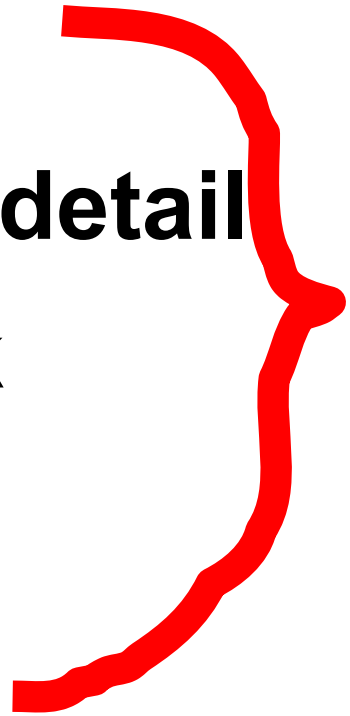
CASC

What is Decaf?

- A CCA framework.
  - 100% v-0.5 compliant
  - Supports “Hello World!” components
- Not a competitor with CCAT or CCAFFIENE
    - Also thought of calling it “mouse”
- Implemented using Babel
  - Proof of Babel’s applicability in CCA
  - research vehicle for us to grok CCA
  - distributed as example in 0.6.0 release

Outline

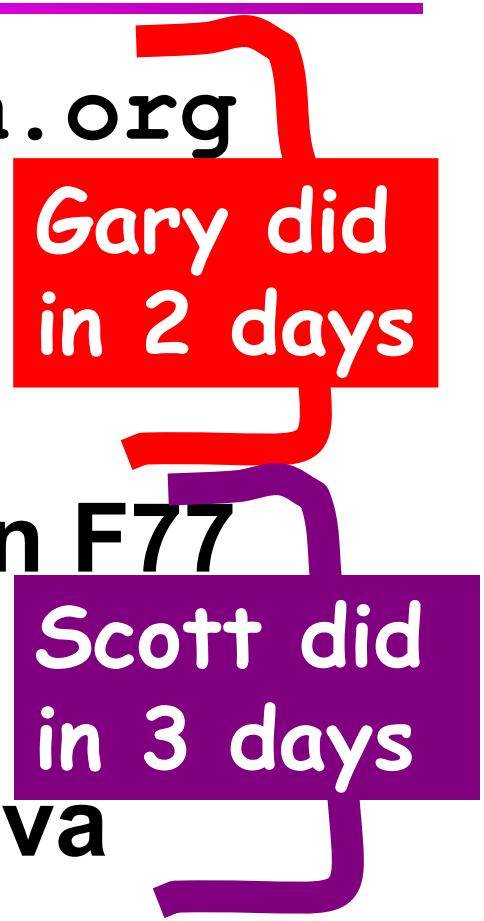
- High Level Discussion
- `cca.sidl` & `decaf.sidl` in detail
- Implementing the framework
- Implementing “Hello World”
- Feedback into the CCA



Highlight Babel's strengths and weaknesses

High Level Discussion

- `cca.sidl` from `cca-forum.org`
- `decaf.sidl` by hand
- Framework in C++
- "Hello World" component in F77
- Printf component in C
- Drivers in F77, Python & Java



Lines of Code (Decaf only)

cca.sidl (excl. comments)	28
decaf.sidl (excl. comments)	12
Generated C/C++ code (wc –l *)	22,067
Hand added Implementation	96

Biggest Time Consumers

- Some Babel Bugfixes
  - new tests added to regression suite
  - Babel 0.6.0 or better required
- Demystifying CCA Spec
  - Lots of missing details
  - How to create a component instance?
  - How to bind a “uses port” to a “provides port”?
  - No main()! Due to GUI heritage?

HelloDriver.java (1/2)

```
public class HelloDriver {
  public static void main(String args[]) {

    decaf.Framework decaf =
          new decaf.Framework();

    cca.ComponentID server =
     decaf.createInstance(
          "HelloServer.Component",
          "HelloServerInstance");

    cca.ComponentID client =
     decaf.createInstance(
          "HelloClient.Component",
          "HelloClientInstance");
```

HelloDriver.java (2/2)

```
    decaf.connect( client, "HelloServer",
                   server, "HelloServer");

    cca.Port port =
          decaf.lookupPort(client, "GoPort");

    cca.ports.GoPort go = (cca.ports.GoPort)
          port._cast("cca.ports.GoPort");

    go.go();

    decaf.destroyInstance( server );
    decaf.destroyInstance( client );
  } // end main
} // end class
```

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Port – Key CCA Abstraction

cca.sidl

```
// cca.sidl
version cca 0.5;
package cca {
    interface Port { }
    …
```

decaf.sidl

```
// decaf.sidl
version decaf 0.5;
package decaf {
    …
```

PortInfo – Port MetaData

cca.sidl

```
interface PortInfo {
     string getType();
     string getName();
     string getProperty( in string name );
}
```

decaf.sidl

```
class PortInfo implements-all cca.PortInfo {
     void initialize(
                  in string name,
                  in string type,
                  in array<string> properties);
}
```

Discussion

Is array<string> appropriate for properties?

Can implement richer data structures.
Should Babel have a standard library?

decaf.sidl

```
class PortInfo implements-all cca.PortInfo {
     void initialize(
                  in string name,
                  in string type,
                  in array<string> properties);
}
```

Component – Base Class for all CCA components

```
interface Component {
  void setServices(
            in Services svcs
       );
}
```

cca.sidl

decaf.sidl

ComponentID – handle to a component

decaf.sidl cca.sidl

```
interface ComponentID {
  string toString();
}
```

```
class ComponentID
implements-all cca.ComponentID {

  void initialize( in string name );

}
```

Services – component's view of the world (1/3)

```
interface Services {
  Port getPort( in string name );
  Port getPortNonblocking( in string name );
  void releasePort( in string name );
  PortInfo createPortInfo(
                in string name,
                in string type,
                in array<string> properties );
  ComponentID getComponentID();
   // …
```

cca.sidl

Services – component's view of the world (2/3)

cca.sidl

```
interface Services {
  // … continued
  void registerUsesPort( in PortInfo pinfo );
  void unregisterUsesPort( in string name );
  void addProvidesPort( in Port inPort,
                        in PortInfo pinfo );
  void removeProvidesPort( in string name );
}
```

Services – component's view of the world (3/3)

```
class Services implements-all cca.Services {

  void bindPort( in string name,
                 in cca.Port port );

  cca.Port getProvidesPort( in string name );

  void setComponentID(
          in cca.ComponentID cid );

}
```

decaf.sidl

Discussion

Components can only access cca.Services, BuildServices needs decaf.Services

If downcasting from cca.Services to decaf.Services, then the components are framework specific.

Evidence of underspecification?

CCA spec needs to enumerate those special components that are not portable and must be implemented by each framework.

Indispensable Ports (1/2)

```
package ports {
  interface GoPort extends Port {
    int go ();
  }
  interface BuilderService extends Port {
    ComponentID createInstance(
          in string className,
          in string requestedInstanceName );
    void destroyInstance( in ComponentID toDie );
    void connect( in ComponentID user,
                  in string usingPortName,
                  in ComponentID provider,
                  in string providingPortName);
  }
}
```

cca.sidl

Indispensable Ports (2/2)

```
class Framework implements-all
        cca.ports.BuilderService {

   cca.Port lookupPort(
              in cca.ComponentID id,
              in string portName );
}
```

decaf.sidl

Discussion

BuilderService is still under discussion and not formally addopted into the spec!

How did anyone build anything without create/connect/destroy functionality?

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Decaf Implementation Details

- Used Babel's C++ Bindings
  - generated 22K lines of code
- Hand edited 8 files
  - added 96 lines of code by hand

decaf_ { PortInfo, ComponentID, Services, Framework } _Impl. { hh, cc }

decaf_PortInfo_Impl.hh

```
// DO-NOT-DELETE splicer.begin(decaf.PortInfo._includes)
#include <map>
// DO-NOT-DELETE splicer.end(decaf.PortInfo._includes)
```

```
namespace decaf {
  class PortInfo_Impl {
  private:
    //...
    // DO-NOT-DELETE splicer.begin(decaf.PortInfo._data)
    std::string d_name;
    std::string d_type;
    std::map<std::string, std::string> d_propertyMap;
    // DO-NOT-DELETE splicer.end(decaf.PortInfo._data)
```

decaf_PortInfo_Impl.cc

```
string
decaf::PortInfo_impl::getProperty(
  /*in*/ string name )
throw ()
{
// DO-NOT-DELETE splicer.begin(decaf.PortInfo.getProperty)
  return d_propertyMap[ name ];
// DO-NOT-DELETE splicer.end(decaf.PortInfo.getProperty)
}
```

```
cca::ComponentID
decaf::Framework_impl::createInstance(
  /*in*/ string className,
  /*in*/ string requestedInstanceName )
throw()
{
  // DO-NOT-DELETE splicer.begin(decaf.Framework.createInstance)
  SIDL::BaseClass sidl_class =
              SIDL::Loader::createClass( className );
  cca::Component component = sidl_class;
  decaf::ComponentID cid;
  if ( component._not_nil() ) {
    string uniqueName = getUniqueName( requestedInstanceName );
    cid = decaf::ComponentID::_create();
    cid.initialize( uniqueName );
    decaf::Services svc = decaf::Services::_create();
    svc.setComponentID( cid );
    d_instance[ uniqueName ] = std::make_pair( component, svc );
    component.setServices( svc );
  }
  return cid;
  // DO-NOT-DELETE splicer.end(decaf.Framework.createInstance)
}
```

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HelloWorld SIDL Files

server.sidl

```
version HelloServer 0.5;
package HelloServer {
  interface HelloPort extends cca.Port {
    string sayHello();
  }
  class Component implements-all
          HelloPort, cca.Component {}
}
```

client.sidl

```
version HelloClient 0.5;
package HelloClient {
  class Component implements-all
     cca.ports.GoPort, cca.Component {}
}
```

HelloServer_Component_Impl.f

```
      subroutine HelloServer_Component_setServices_impl(
     &     self, services)
C ...
      call SIDL_string__array_create_f(1, 0, 0, properties)
      call cca_Services_createPortInfo_f(
     &    services,
     &    'HelloServer',
     &    'HelloServer.HelloPort',
     &    properties,
     &    portinfo)
      call HelloServer_Component__cast_f(self, 'cca.Port',
     &    port)
      call cca_Services_addProvidesPort_f(services, port,
     &    portinfo)
      call cca_PortInfo_deleteReference_f(portinfo)
      call SIDL_string__array_destroy_f(properties)
```

HelloDriver.py (1/2)

```
import decaf.Framework
import cca.ports.GoPort

if __name__ == '__main__':
  decaf = decaf.Framework.Framework()

  server = decaf.createInstance(
           "HelloServer.Component",
           "HelloServerInstance");

  client = decaf.createInstance(
           "HelloClient.Component",
           "HelloClientInstance");
```

HelloDriver.py (2/2)

```
decaf.connect(client,"HelloServer",
              server,"HelloServer")

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

go.go()

decaf.destroyInstance(server)
decaf.destroyInstance(client)
```

HelloDriver.py (1/2)

```
import decaf.Framework
import cca.ports.GoPort

if __name__ == '__main__':
  decaf = decaf.Framework.Framework()

  server = decaf.createInstance(
           "HelloServer.Component",
           "HelloServerInstance");

  client = decaf.createInstance(
           "HelloClient.Component",
           "HelloClientInstance");
```

What's non-standard?

HelloDriver.py (2/2)

What's non-standard?

```
decaf.connect(client,"HelloServer",
              server,"HelloServer")

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

go.go()

decaf.destroyInstance(server)
decaf.destroyInstance(client)
```

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Feedback about CCA Spec

- minimal
  - *to the point of being unusable*
  - *cannot implement "Hello World! as is*
- doesn't standardize driving from main()
  - *More people probably care about scripted assembly than GUIs… and it scales better!*
- no create/bind/go/destroy in core spec
- Recommend a cca.Framework interface
- Recommend looking at Babel's SIDL::Loader

Babel is Ready for CCA

- Demonstrated language independent CCA components.
- Not necessarily Bug Free.
- Babel's firewall between interface and implementation forces better software design
- Is CCA ready for Babel?

The End

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