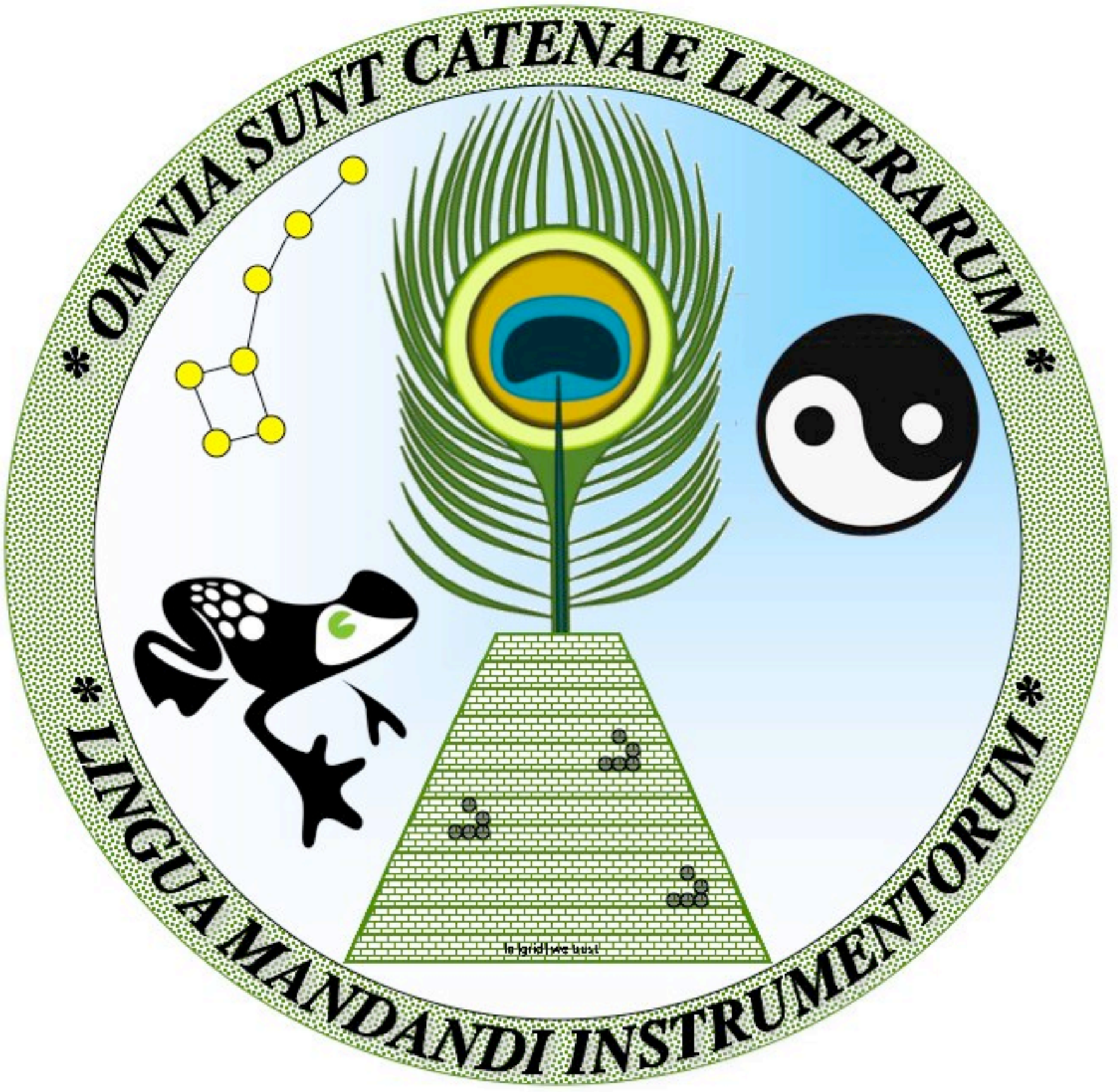
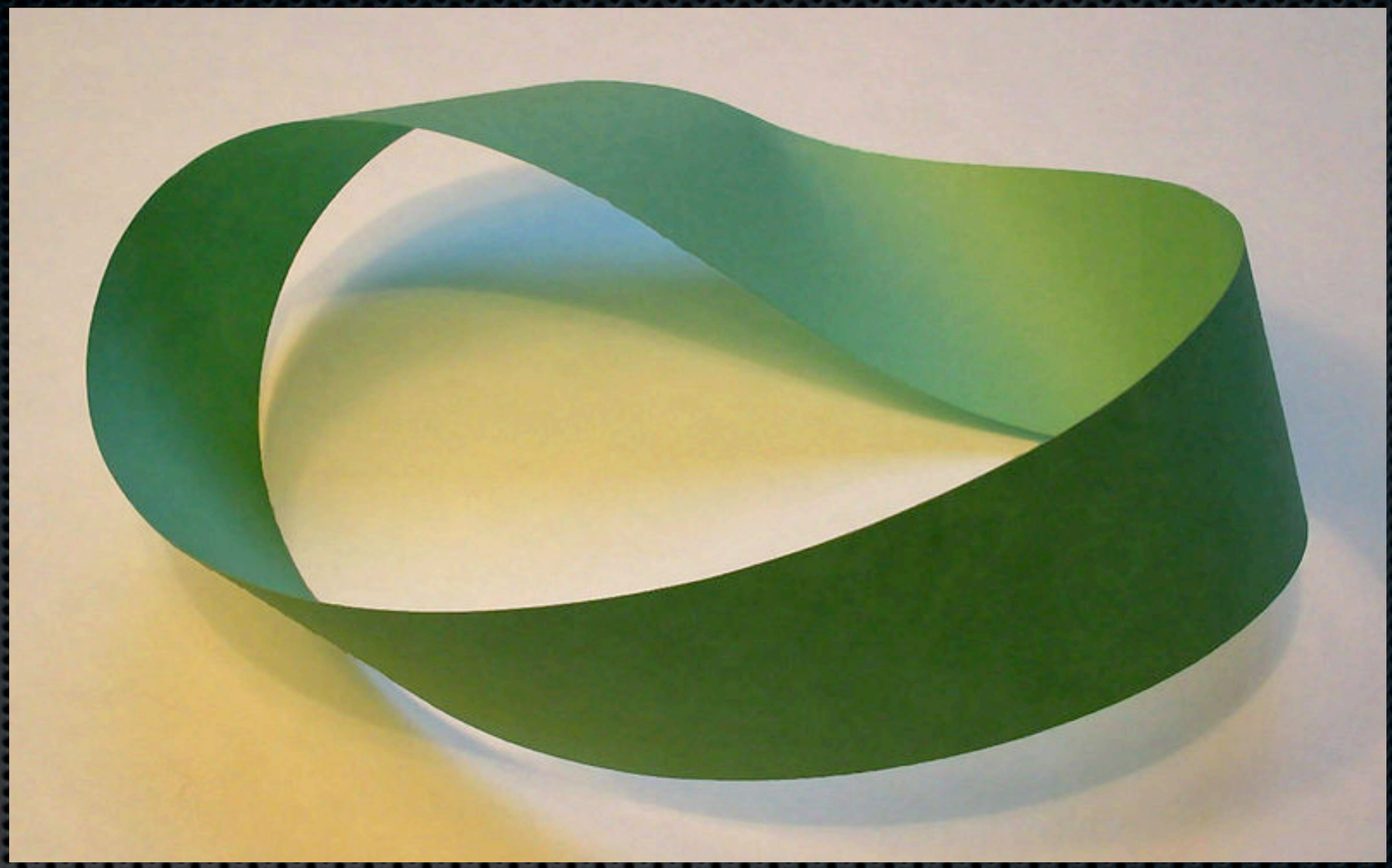

* OMNIA SUNT CATENAE LITTERARUM *
* LINGUA MANDANDI INSTRUMENTORUM *



CTHULHU

Using Tcl to build C to build Tcl Applications

CTHULHU

C and **T**cl **H**ashtable **U**nderpinnings for
Language **H**igh-level **U**nderstanding

CTHULHU

C and **T**cl **H**ashtable **U**nderpinnings for
Language **H**igh-level **U**nderstanding

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C

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CTHULHU

C and **T**cl **H**ashtable **U**nderpinnings for
Language **H**igh-level **U**nderstanding

Background

Background

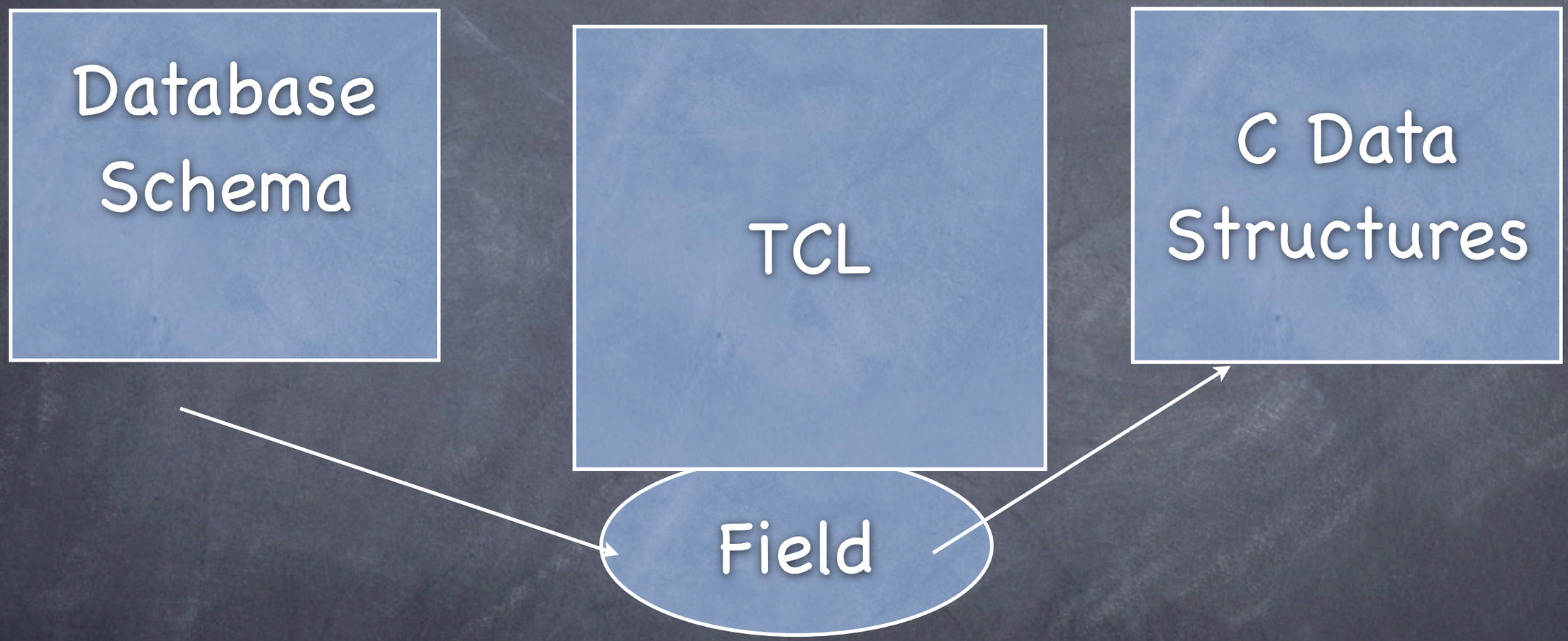
Database Schema

Background

Database Schema

C Data Structures

Background

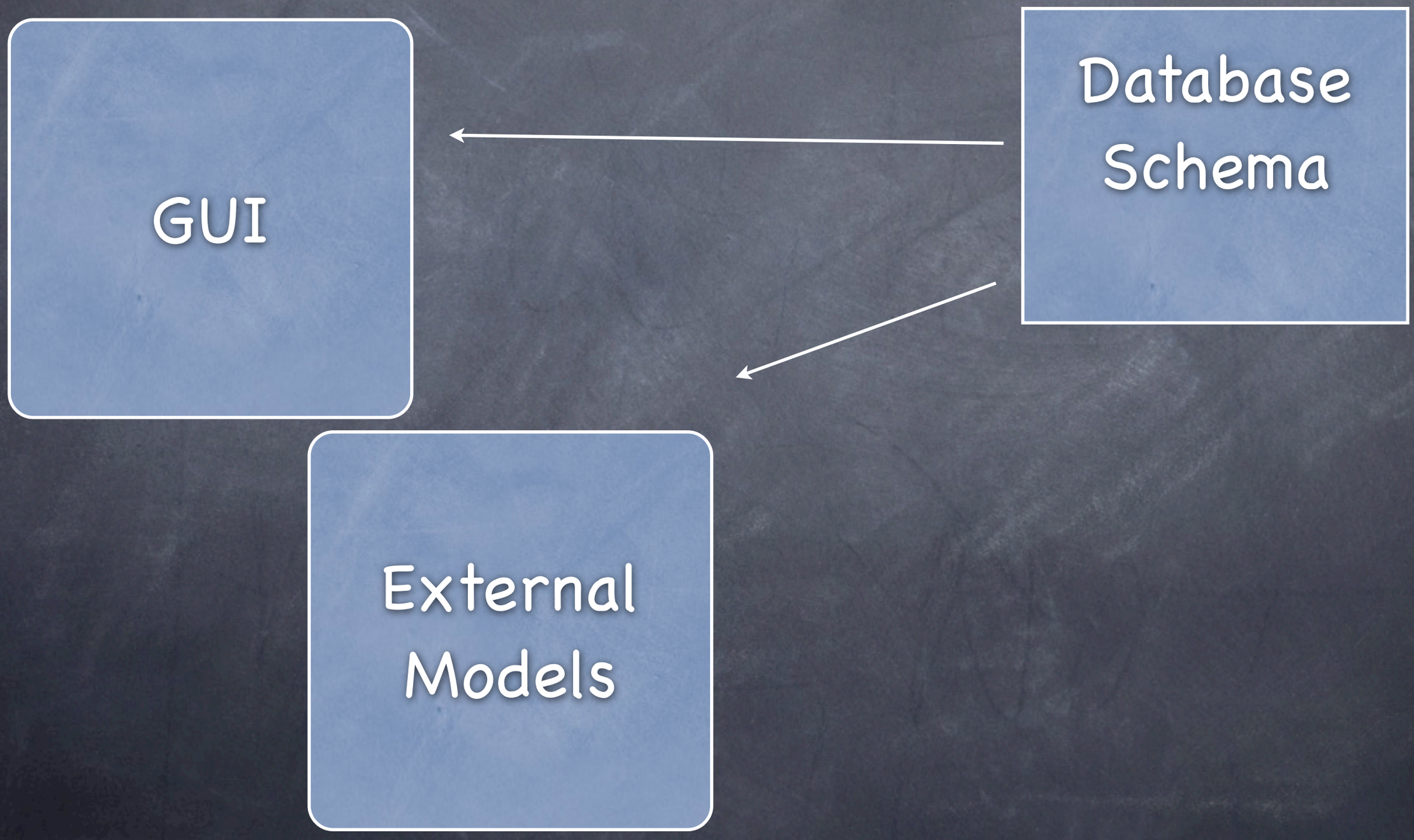


Background

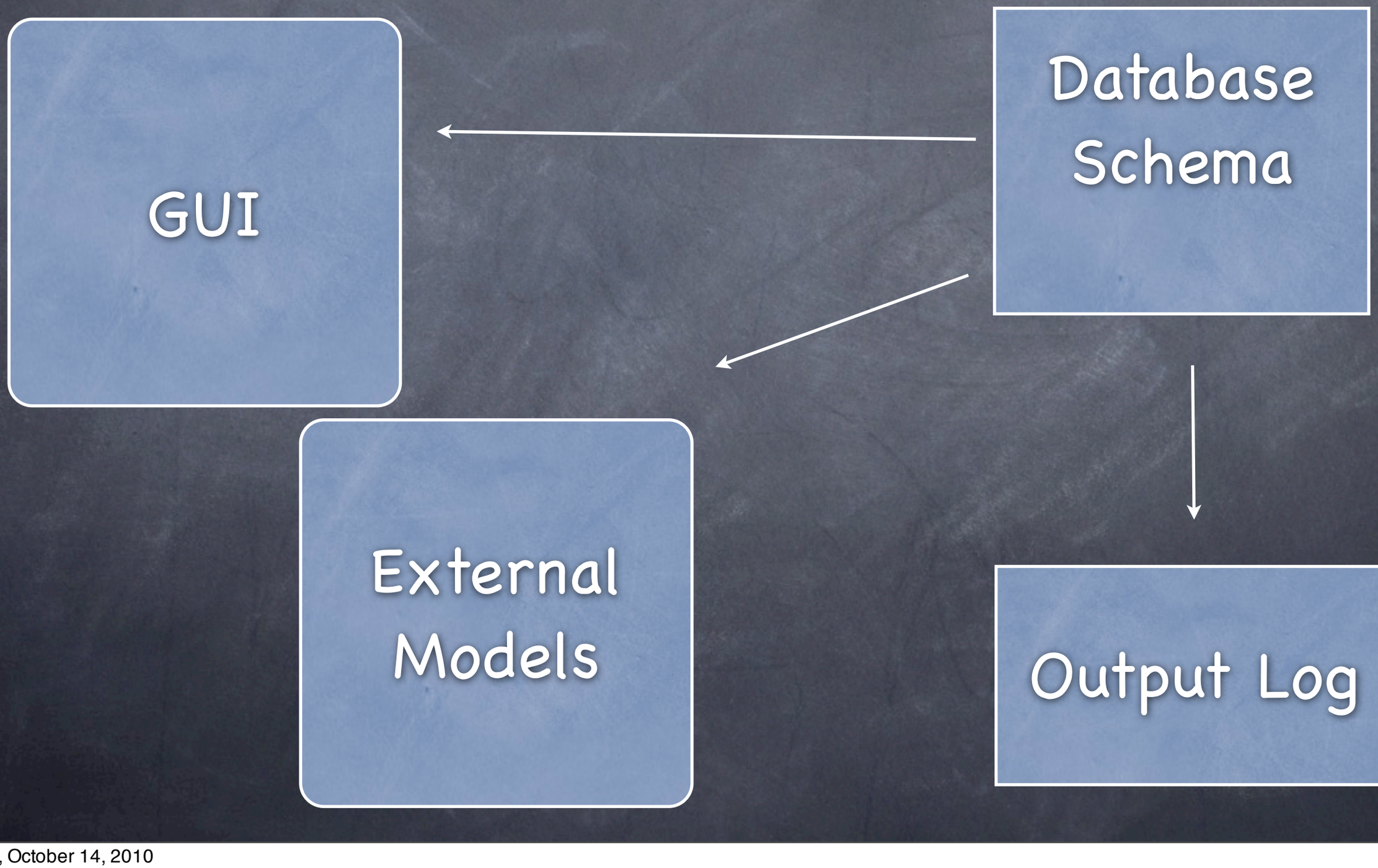
Database Schema

Background

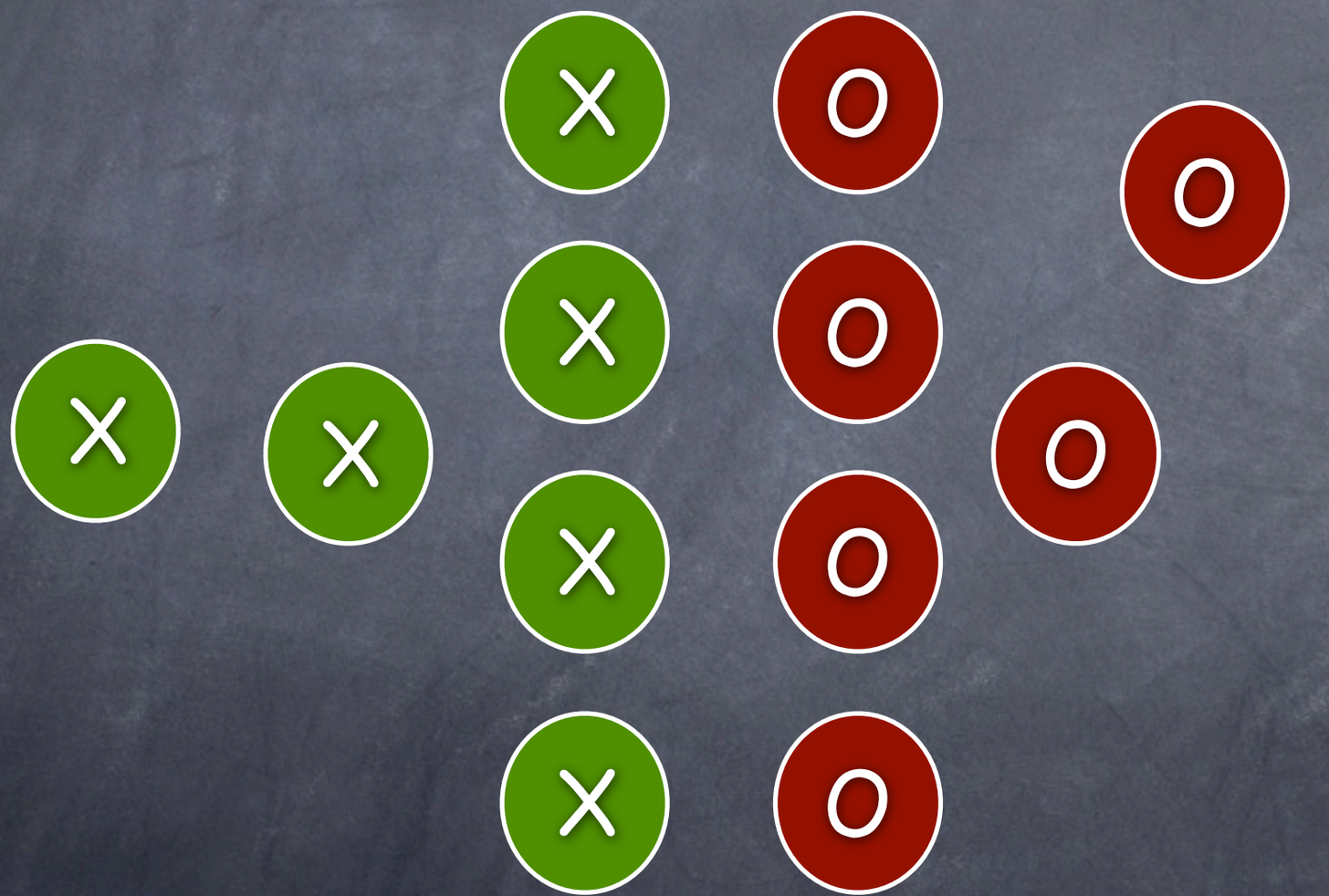
Background



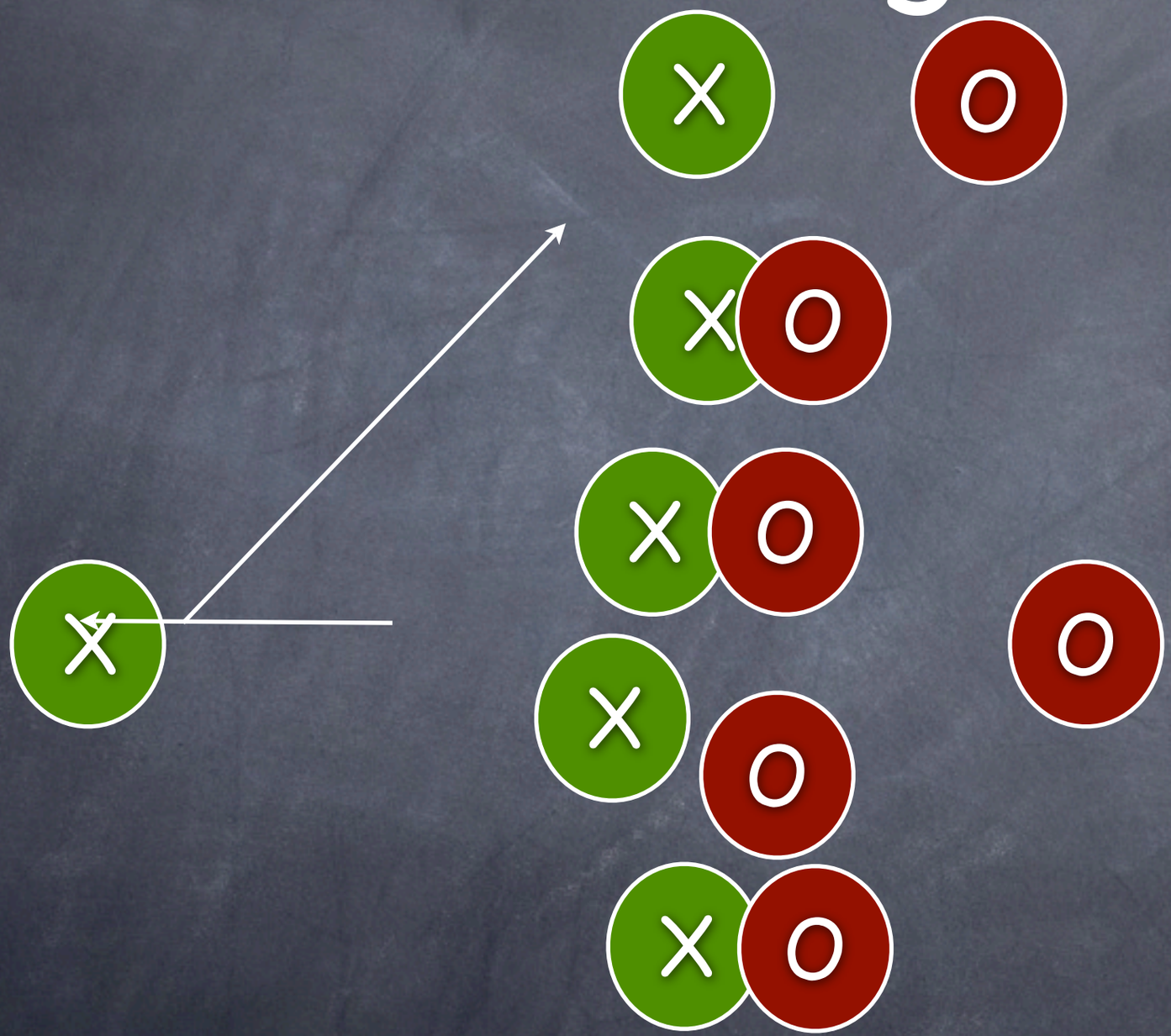
Background



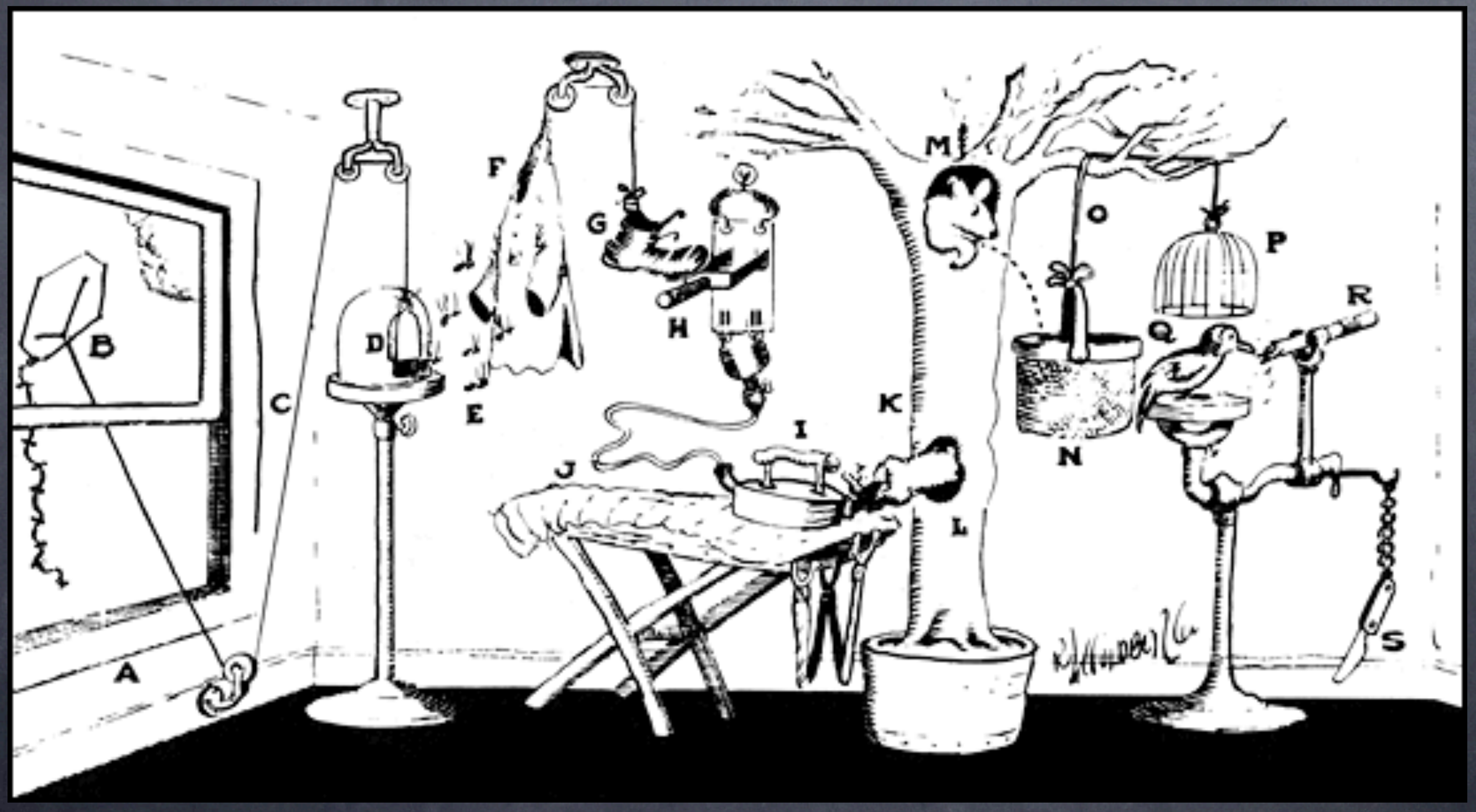
Background



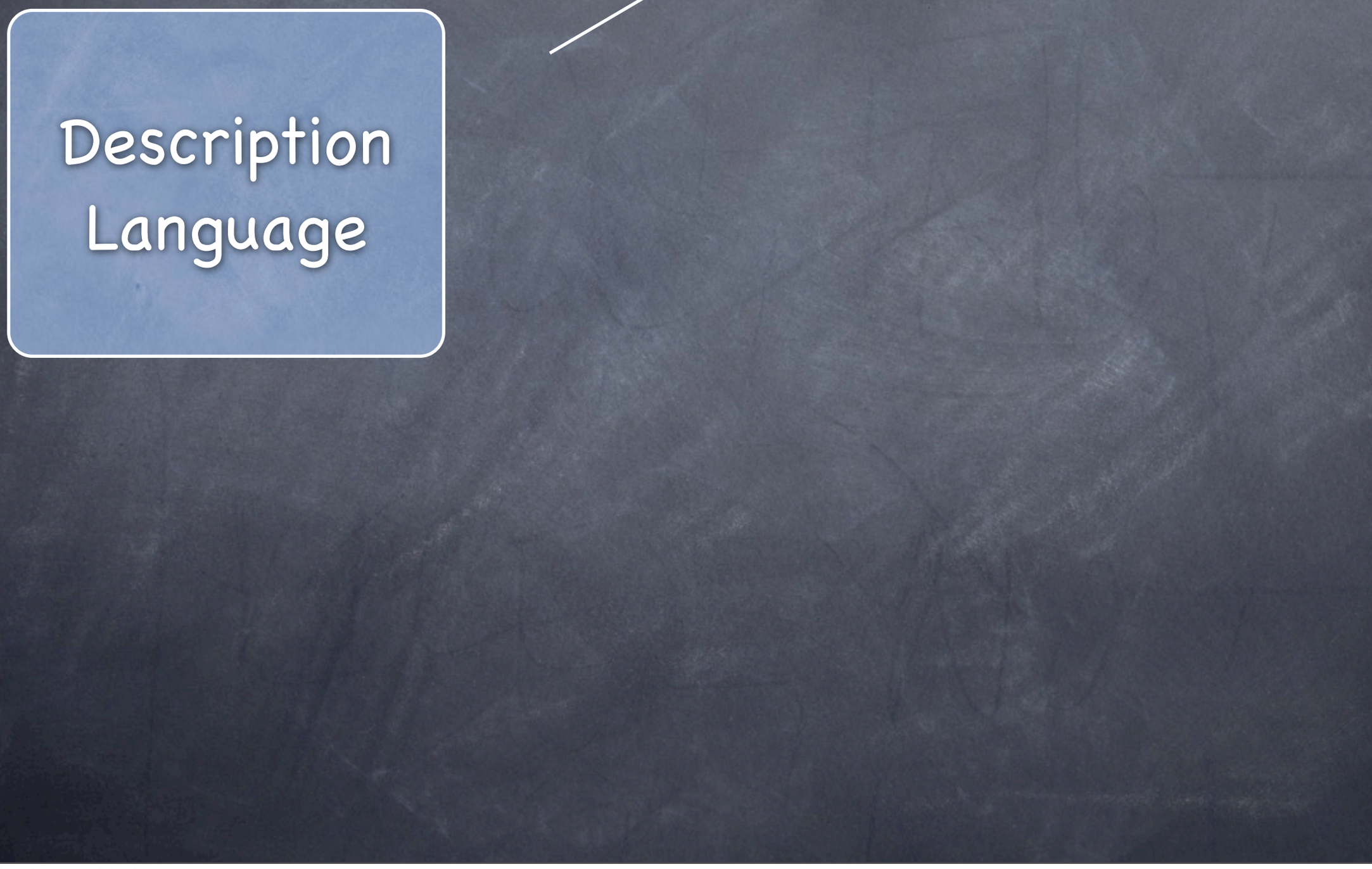
Background

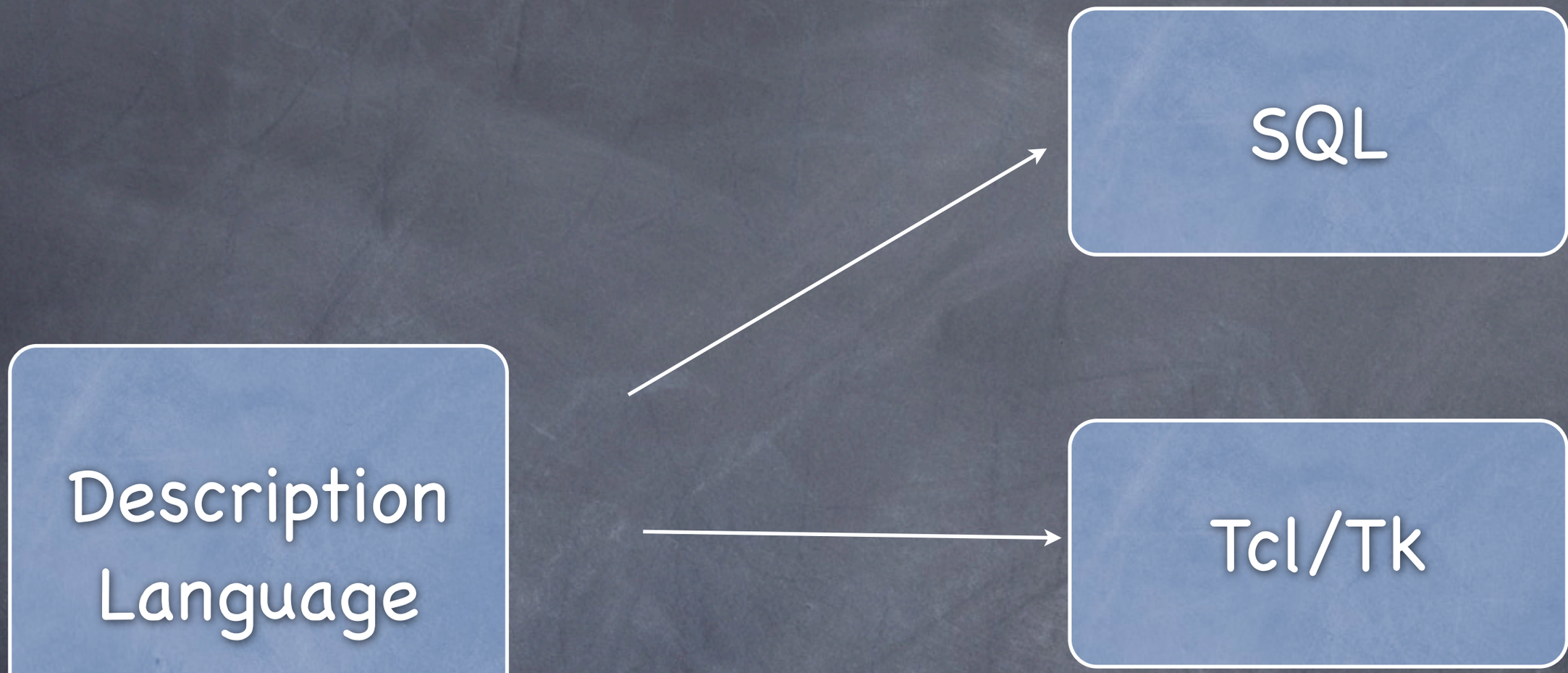


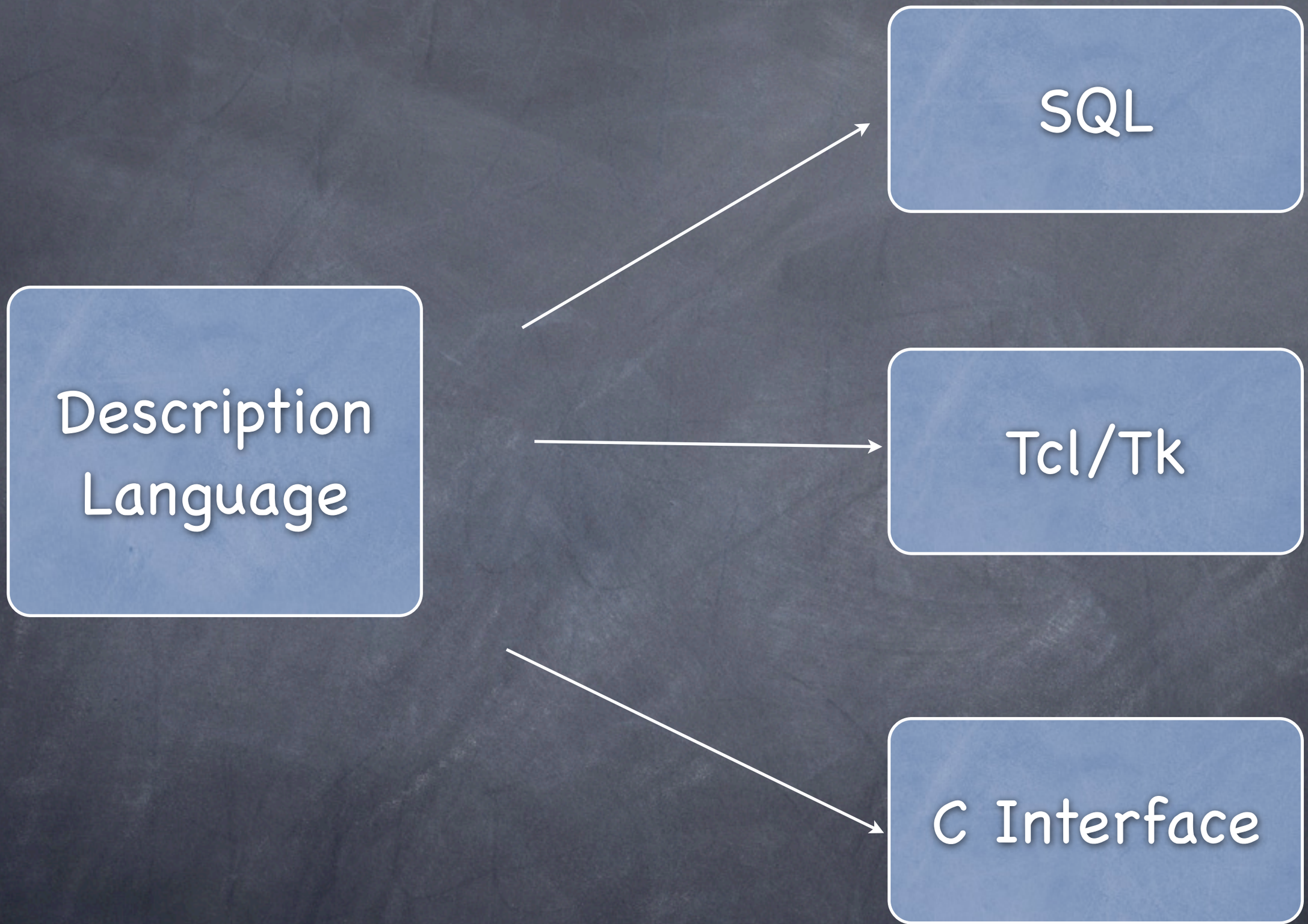
Background

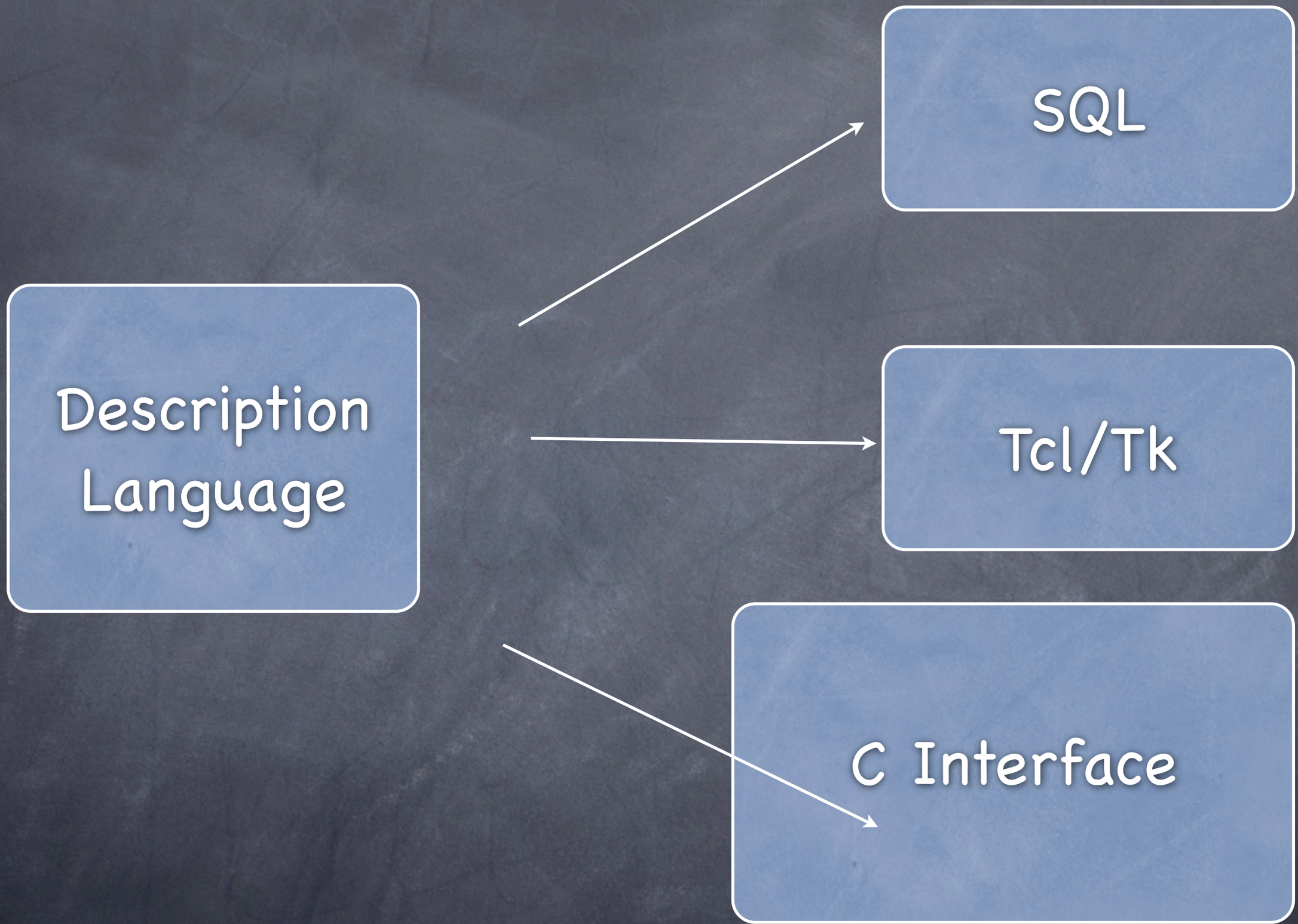


Description Language


SQL
Description
Language


Description Language
SQL
Tcl/Tk


Description Language
SQL
Tcl/Tk
C Interface


SQL
Description Language
Tcl/Tk
C Interface

Description Language

C Interface

CTHULHU Description Language

- Ph'nglui mglw'nafh Cthulhu R'lyeh wgah'nagl fhtagn

CTHULHU Description Language

CTHULHU Description Language

- Dict Based

CTHULHU Description Language

- Dict Based
- Combines the needs of the GUI, the database, and C

CTHULHU Description Language

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- Combines the needs of the GUI, the database, and C
- Captures suggested storage, display, validation rules

CTHULHU Description Language

- Dict Based
- Combines the needs of the GUI, the database, and C
- Captures suggested storage, display, validation rules
- Comes with a free frogurt

CTHULHU Description Language

cstructDefine portal {

}

CTHULHU Description Language

```
cstructDefine portal {
    keytype int
}
```

CTHULHU Description Language

```
cstructDefine portal {
  keytype int
  hashtype tcl
}
```

CTHULHU Description Language

```
cstructDefine portal {
   keytype int
   hashtype tcl
    fields {
    }
}
```

```
cstructDefine portal {
  keytype int
  hashtype tcl
  fields {
    toid { ... }
    fromid { ... }
  }
}
```

```
...
    toid {
        storage Roid
        references compt
        description { ... }
    }
...
```

```
...
    cake {
      storage Bool
      description {There will be cake}
      default 1
    }
...
```

```
...
    open {
      storage u2
      values {
          0 closed  {Closed}
          1 open    {Open}
          2 closing {Closing}
          3 opening {Opening}
      }
    }
...
```

```
cstructDefine portal {
   keytype int
  hashtype tcl
  fields { ... }
   static {
      Roid id;
      Entity *pType;
      Portal *delta
   }
}
```

```
/* Define the Portal Structure */
#define PORTAL_JAMMED_NORMAL 0 /* Door...
#define PORTAL_JAMMED_JAM_OPEN 2 /* Do...
#define PORTAL_OPEN_NORMAL 0 /* Door i...
#define PORTAL_OPEN_OPEN 1 /* Door is ...
#define PORTAL_OPEN_OPENING 2 /* Crew ...
#define PORTAL_OPEN_CLOSING 3 /* Crew ...
struct Portal {
   /* Place holder for ID */
   Tcl_Obj *idString;
   /* Begin hard-coded structure */

   Roid id;              /* Numeric ID ...
   Entity *pType;
   Portal *delta;

   Compartment *pFrom;  /* Compartment ...
   Compartment *pTo;    /* Compartment ...
   Crew *holding;       /* Crewmember  ...
   Portal *airlock;     /* Pointer to i...

   float public_flooding; /* flooding e...
   Roid public_fromid; /* fromid eoc */
   Roid public_toid; /* toid eoc */
   /*Begin bitmap*/
   unsigned int public_jammed    :4; /*...
   unsigned int public_open    :4; /* o...
   unsigned int public_reserved    :1; ...
};
```

```
const struct IrmParamNameMap Portal_paramNameMap[] = {
  { "damage", CSTRUCT_PORTAL_DAMAGE, PTYPE_INT },
  { "flooding", CSTRUCT_PORTAL_FLOODING, PTYPE_FLOAT },
  { "fromid", CSTRUCT_PORTAL_FROMID, PTYPE_INT },
  { "junction_type", CSTRUCT_PORTAL_JUNCTION_TYPE, PTYPE_INT },
  { "open", CSTRUCT_PORTAL_OPEN, PTYPE_INT },
  { "opening", CSTRUCT_PORTAL_OPENING, PTYPE_FLOAT },
  { "reserved", CSTRUCT_PORTAL_RESERVED, PTYPE_INT },
  { "toid", CSTRUCT_PORTAL_TOID, PTYPE_INT },
};

void Portal_DictPut(Portal *p,Tcl_Obj *key,Tcl_Obj *value) {
  if(!p->pType) {
    Portal_Generic_Alloc(p);
  }
  Entity_DictPut(p->pType,key,value);
}
Tcl_Obj *Portal_DictGet(Portal *p,Tcl_Obj* key) {
  if(!p->pType) {
    return NULL;
  }
  return Entity_DictGet(p->pType,key);
}


    /* Define the $StructName_StructSet function */

int Portal_StructSet(Tcl_Interp *interp,Portal *pNode,int field,Tcl_Obj *value)
{
if(field < 0 || field > CSTRUCT_PORTAL_Count) {
  const struct IrmParamNameMap *aParam = Spec_paramNameMap;
  Tcl_AppendResult(interp, aParam[field].zName, " is not a field for $structname", 0);
  return TCL_ERROR;
}

switch (field) {
  case CSTRUCT_PORTAL_DAMAGE: {
        int intValue;
        double floatValue;
        if(Tcl_GetDoubleFromObj(interp,value,&floatValue)==TCL_OK) {
          intValue=(int)floatValue;
        } else {
          /* Bag, we have a bad value */
          return TCL_ERROR;
        }
        pNode->public_damage=intValue; return TCL_OK;
        }
  case CSTRUCT_PORTAL_FLOODING: {
      double floatValue;
      if(Tcl_GetDoubleFromObj(interp,value,&floatValue)==TCL_OK) {
        pNode->public_flooding=(float)floatValue; return TCL_OK;
      }
      return TCL_ERROR;
      }
  case CSTRUCT_PORTAL_FROMID: {
        int intValue;
        double floatValue;
        if(Tcl_GetDoubleFromObj(interp,value,&floatValue)==TCL_OK) {
          intValue=(int)floatValue;
        } else {
          /* Bag, we have a bad value */
          return TCL_ERROR;
        }
```

```
      intValue=(int)floatValue;
    } else {
      /* Bag, we have a bad value */
      return TCL_ERROR;
    }
    pNode->public_fromid=intValue; return TCL_OK;
    }
case CSTRUCT_PORTAL_JUNCTION_TYPE: {
    int intValue;
    double floatValue;
    if(Tcl_GetDoubleFromObj(interp,value,&floatValue)==TCL_OK) {
      intValue=(int)floatValue;
    } else {
      /* Bag, we have a bad value */
      return TCL_ERROR;
    }
    pNode->public_junction_type=intValue; return TCL_OK;
    }
case CSTRUCT_PORTAL_OPEN: {
    int intValue;
    double floatValue;
    if(Tcl_GetDoubleFromObj(interp,value,&floatValue)==TCL_OK) {
      intValue=(int)floatValue;
    } else {
      /* Bag, we have a bad value */
      return TCL_ERROR;
    }
    pNode->public_open=intValue; return TCL_OK;
    }
case CSTRUCT_PORTAL_OPENING: {
    double floatValue;
    if(Tcl_GetDoubleFromObj(interp,value,&floatValue)==TCL_OK) {
      pNode->public_opening=(float)floatValue; return TCL_OK;
    }
    return TCL_ERROR;
    }
  case CSTRUCT_PORTAL_RESERVED: {
        int intValue;
        double floatValue;
        if(Tcl_GetDoubleFromObj(interp,value,&floatValue)==TCL_OK) {
          intValue=(int)floatValue;
        } else {
          /* Bag, we have a bad value */
          return TCL_ERROR;
        }
        pNode->public_reserved=intValue > 0; return TCL_OK;
        }
  case CSTRUCT_PORTAL_TOID: {
        int intValue;
        double floatValue;
        if(Tcl_GetDoubleFromObj(interp,value,&floatValue)==TCL_OK) {
          intValue=(int)floatValue;
        } else {
          /* Bag, we have a bad value */
          return TCL_ERROR;
        }
        pNode->public_toid=intValue; return TCL_OK;
        }
  }
  return TCL_OK;
}
```

```
  /* Define the $StructName_StructGet function */

Tcl_Obj *Portal_StructGet(Portal *pNode,int field)
{


  switch (field) {
    case CSTRUCT_PORTAL_DAMAGE: return object_Integer(pNode->public_damage);
    case CSTRUCT_PORTAL_FLOODING: return Tcl_NewDoubleObj(pNode->public_flooding);
    case CSTRUCT_PORTAL_FROMID: return object_Integer(pNode->public_fromid);
    case CSTRUCT_PORTAL_JUNCTION_TYPE: return object_Integer(pNode->public_junction_type);
    case CSTRUCT_PORTAL_OPEN: return object_Integer(pNode->public_open);
    case CSTRUCT_PORTAL_OPENING: return Tcl_NewDoubleObj(pNode->public_opening);
    case CSTRUCT_PORTAL_RESERVED: return object_Boolean(pNode->public_reserved);
    case CSTRUCT_PORTAL_TOID: return object_Integer(pNode->public_toid);
  }


return NULL;
}

void Portal_AddLocation(Tcl_Interp *interp,Portal *p, Tcl_Obj *pValueDict) {
  Tcl_Obj *tempval;

  Tcl_DictObjPut(0,pValueDict,constant_stringObj(interp,"deckid"),Tcl_NewIntObj(p->deckid));
  if(p->deckid) {
    tempval=Tcl_NewObj();
    Tcl_ListObjAppendElement(0, tempval, Tcl_NewIntObj(p->deckid));
    Tcl_ListObjAppendElement(0, tempval, Tcl_NewIntObj(p->x));
    Tcl_ListObjAppendElement(0, tempval, Tcl_NewIntObj(p->y));
    Tcl_ListObjAppendElement(0, tempval, Tcl_NewIntObj(p->zoff));
    Tcl_DictObjPut(interp,pValueDict,constant_stringObj(interp,"center"),tempval);
  }
  tempval=Tcl_NewObj();
  Tcl_ListObjAppendElement(0, tempval, Tcl_NewIntObj(p->nx));
  Tcl_ListObjAppendElement(0, tempval, Tcl_NewIntObj(p->ny));
  Tcl_ListObjAppendElement(0, tempval, Tcl_NewIntObj(p->nz));
  Tcl_DictObjPut(0,pValueDict,constant_stringObj(interp,"orientation"),tempval);
}


void Portal_SetType(Portal *p,SimType *pType) {
  if(!p->pType) {
    return;
  }
  Entity_SetType(p->pType,pType);
}

SimType *Portal_GetType(Portal *p) {
  if(p->pType) {
    return Entity_GetType(p->pType);
  }
  return NULL;
}

Tcl_Obj *Portal_ToDict(Tcl_Interp *interp,Portal *p) {
  Tcl_Obj *pResult=NULL;
  int i;
  if(p->pType) {
```

```
Tcl_Obj *Portal_ToDict(Tcl_Interp *interp,Portal *p) {
  Tcl_Obj *pResult=NULL;
  int i;
  if(p->pType) {
    pResult=Entity_ToDict(interp,p->pType);
  }
  if(!pResult) {
    pResult=Tcl_NewObj();
  }
  /* Finaly, Add the Tcl Data */
  for(i=0;i<CSTRUCT_PORTAL_Count;i++) {
    Tcl_Obj *newElement=Portal_StructGet(p,i);
    if(newElement) {
      Tcl_DictObjPut(interp,pResult,constant_stringObj(interp,Portal_paramNameMap[i].zName),newElement);
    }
  }
  return pResult;
}


    /* Define the $StructName_StructChanged function */


int Portal_StructChanged(Portal *pNode,int field, int embargo, int force)
{

    if(field < 0) return 0;
    if(field > CSTRUCT_PORTAL_Count)
      return 0;
    if(!pNode->delta) force=1;
    /* No Photo, no comment */

  switch (field) {
    case CSTRUCT_PORTAL_DAMAGE:
          if(force) return 1;
          return pNode->public_damage != pNode->delta->public_damage;
    case CSTRUCT_PORTAL_FLOODING:
          if(force) {
            return pNode->public_flooding != 0.0;
          }
          return pNode->public_flooding != pNode->delta->public_flooding;

    case CSTRUCT_PORTAL_OPEN:

          if(force) return 1;
          return pNode->public_open != pNode->delta->public_open;
    case CSTRUCT_PORTAL_OPENING:
          if(force) {
            return pNode->public_opening != 0.0;
          }
          return pNode->public_opening != pNode->delta->public_opening;

  }
  return 0;
}
```

```
void Portal_StructAdvance(void) {
  Tcl_HashSearch search;
  Tcl_HashEntry *i;

  for(i=PortalFirst(&search); i ; i = Tcl_NextHashEntry(&search)) {
    Portal *p = (Portal*)Tcl_GetHashValue(i);
    Portal_UpdateGui(p);
    memcpy(p->delta,p,sizeof(*p));
  }

}

void Portal_Generic_Alloc(Portal *p)
{
  if (!p->delta) {
    p->delta=(Portal *) IRM_Alloc(sizeof(*p));
    memcpy(p->delta,p,sizeof(*p));
  }


}


void Portal_Generic_Free(Portal *p)
{

    if (p->delta) {
      IRM_Free((char *)p->delta);
      p->delta=0;
    }


}



Tcl_Obj *Portal_Identify(Portal *pNode) {
  if(!pNode) {
    return Tcl_NewWideIntObj(0);
  }
  return Tcl_NewWideIntObj(pNode->id);
}
Tcl_Obj *Portal_TypeId(Portal *pNode) {
  SimType *pType;
  if(!pNode) {
    return Tcl_NewIntObj(0);
  }
  pType=Portal_GetType(pNode);
```

```
  SimType *pType;
  if(!pNode) {
    return Tcl_NewIntObj(0);
  }
  pType=Portal_GetType(pNode);
  if(!pType) {
    return Tcl_NewIntObj(0);
  }
  return Tcl_NewWideIntObj(pType->id);
}


/*
** Find a Portal given a Tcl_Obj that contains the Portal ID.
** Leave an error message in interp and return TCL_ERROR if anything
** goes wrong.
*/
int Portal_FromTclObj(Tcl_Interp *interp, Tcl_Obj *pObj, Portal **ppPortal){
  Roid i;

  if( Tcl_GetIntFromObj(interp, pObj, &i) ) {
    Tcl_Obj *substring=qdStringObjLeftTrim(pObj,'p');
    if (!substring) {
      return TCL_ERROR;
    }
    if(Tcl_GetIntFromObj(interp, substring, &i)) {
      Tcl_DecrRefCount(substring);
      return TCL_ERROR;
    }
    Tcl_DecrRefCount(substring);
    Tcl_ResetResult(interp);
  }
  *ppPortal = PortalById(i, 0);
  if( *ppPortal==0 ){
    Tcl_AppendResult(interp, "no such portal: ",
      Tcl_GetStringFromObj(pObj, 0),  0);
    return TCL_ERROR;
  }
  return TCL_OK;
}


/*
** Given the name of one of the arState[] values in the Portal_ structure,
** return the index of the particular arState[].  Return TCL_OK.
**
** Leave an error message in interp and return TCL_ERROR if
** anything goes wrong.
*/
```

```
/*
** Given the name of one of the arState[] values in the Portal_ structure,
** return the index of the particular arState[].  Return TCL_OK.
**
** Leave an error message in interp and return TCL_ERROR if
** anything goes wrong.
*/
int Portal_ValueOffset(
  Tcl_Interp *interp,
  Tcl_Obj *pObj,
  int *pIndex,
  int *pType
){
  int lo, hi, mid, c, max, i;
  int nName;
  const char *zName;
  const struct IrmParamNameMap *aParam = Portal_paramNameMap;

  lo = 0;
  hi = max = CSTRUCT_PORTAL_Count - 1;
  zName = Tcl_GetStringFromObj(pObj, &nName);
  mid = (lo+hi)/2;

  while( lo<=hi ){
    mid = (lo+hi)/2;
    c = strncmp(zName, aParam[mid].zName, nName);
    if( c<0 ){
      hi = mid-1;
    }else if( c>0 ){
      lo = mid+1;
    }else if(
      (mid>0 && strncmp(zName, aParam[mid-1].zName, nName)==0) ||
      (mid<max && strncmp(zName, aParam[mid+1].zName, nName)==0)
    ){
      i = mid;
      while( i>0 && strncmp(zName, aParam[i-1].zName, nName)==0 ){
        i--;
      }
      if( strlen(aParam[i].zName)==nName ){
        *pIndex = aParam[i].iCode;
        *pType = aParam[i].pType;
        return TCL_OK;
      }
      if(interp) {
        Tcl_AppendResult(interp, "ambiguous parameter:", 0);
        do{
          Tcl_AppendResult(interp, " ", aParam[i++].zName, 0);
        }while( i<=max && strncmp(zName, aParam[i].zName, nName)==0 );
      }
      return TCL_ERROR;
    }else{
      *pIndex = aParam[mid].iCode;
      *pType = aParam[mid].pType;
      return TCL_OK;
    }
  }
  if(interp) {
    Tcl_AppendResult(interp, "unknown parameter \"", zName,
            "\" - nearby choices:", 0);
    for(i=mid-3; i<mid+3; i++){
      if( i<0 || i>max ) continue;
      Tcl_AppendResult(interp, " ", aParam[i].zName, 0);
    }
  }
  return TCL_ERROR;
}


/*
** title:
```

```
}


/*
** title:
*/
int Portal_nodeeval(
  Tcl_Interp *interp,
  Portal *p,
  Tcl_Obj *body
) {
  Tcl_Obj *pValueDict;
  int i;
  Tcl_Obj **varv;
  int varc,result;

  pValueDict=Portal_ToDict(interp,p);
  if (Tcl_ListObjGetElements(interp, pValueDict, &varc, &varv) != TCL_OK) {
      return TCL_ERROR;
  }
  for(i=0;i<varc;i+=2) {
    Tcl_ObjSetVar2(interp, varv[i], (Tcl_Obj *)NULL, varv[i+1], 0);
  }
  Tcl_ObjSetVar2(interp,constant_stringObj(interp,"id"),NULL,Portal_Identify(p),0);
  Tcl_ObjSetVar2(interp,constant_stringObj(interp,"typeid"),NULL,Portal_TypeId(p),0);


  result=Tcl_EvalObjEx(interp, body, 0);
  if(result!=TCL_OK) {
    if(pValueDict) {
      Tcl_DecrRefCount(pValueDict);
    }
    return result;
  }
  {
    /*
    ** Read values back into the dict
    ** For now, we limit writeback to state variables
    ** And we don't care about garbage values
    */
    for(i=0;i<varc;i+=2) {
      Tcl_Obj *newValue;
      int offset;
      int type;
      newValue=Tcl_ObjGetVar2(interp,varv[i],(Tcl_Obj *)NULL,0);
      if(newValue==varv[i+1]) {
         /* Undocumented, unsanctioned, but it works in practice
         ** If the pointer hasn't changed, neither has the value
         */
         continue;
      }
      if(!newValue) {
        /* Variable must have been unset... move along */
        continue;
      }
      if( Portal_ValueOffset(0, varv[i], &offset, &type) == TCL_OK ) {
          Portal_StructSet(interp,p,offset,newValue);
      } else {
        Portal_DictPut(p,varv[i],newValue);
      }
    }
    Portal_ApplySettings(p);
  }
  if(pValueDict) {
    Tcl_DecrRefCount(pValueDict);
  }
  return TCL_OK;
}
```

Code Generation

The implementation of the Portal Structure example was 455 lines. (Including comments.)

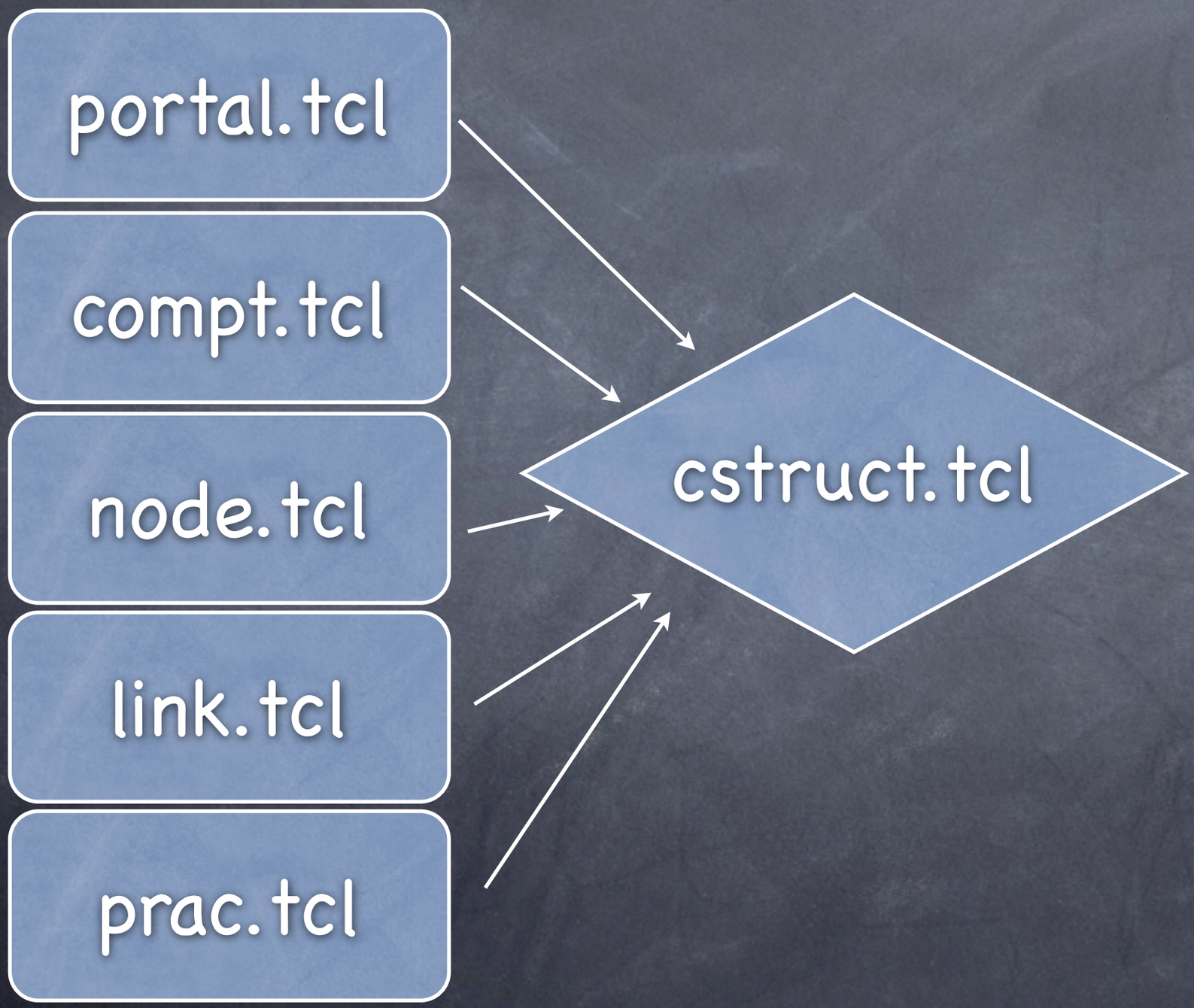
The Product

portal.tcl

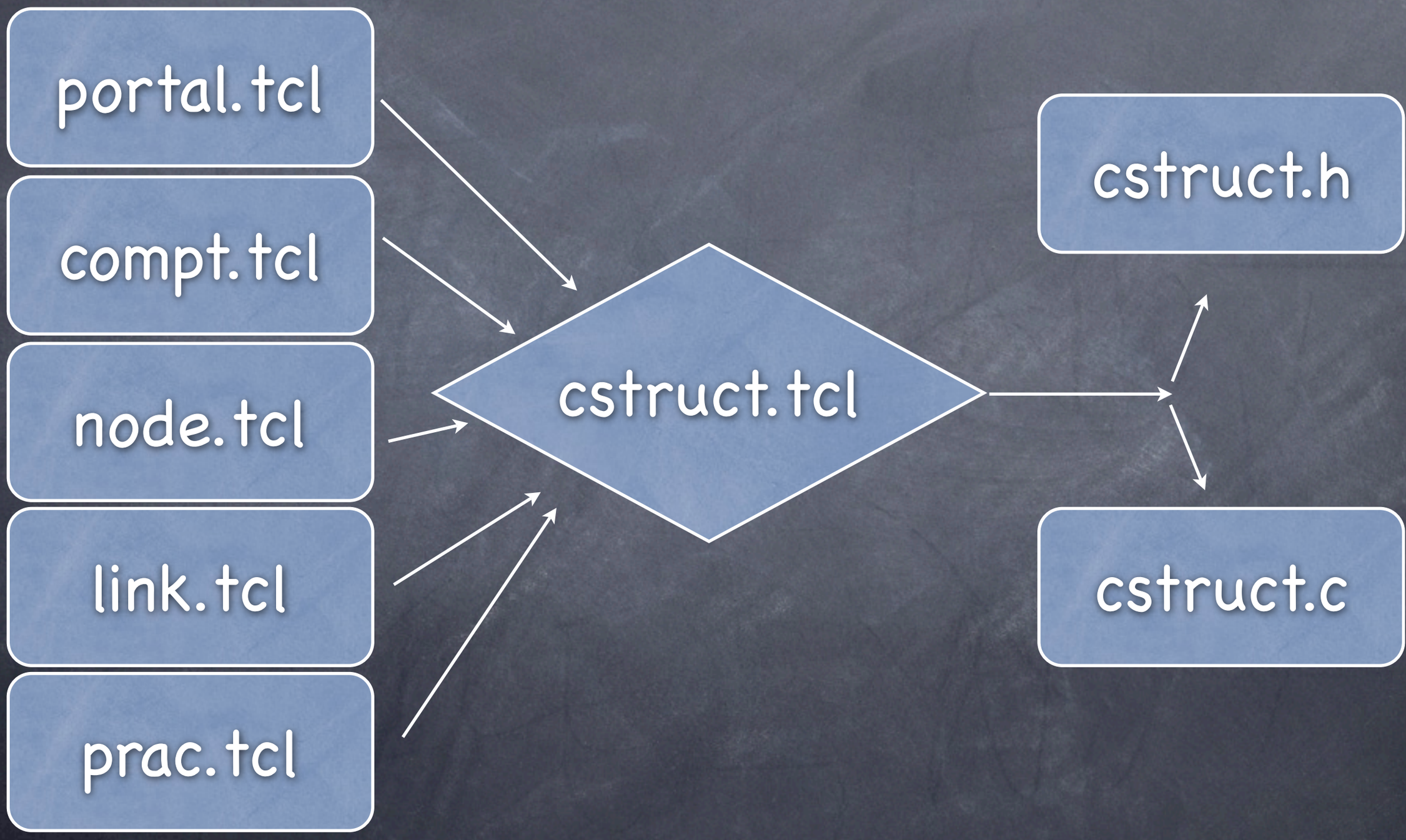
The Product

- portal.tcl
- compt.tcl
- node.tcl
- link.tcl
- prac.tcl

The Product

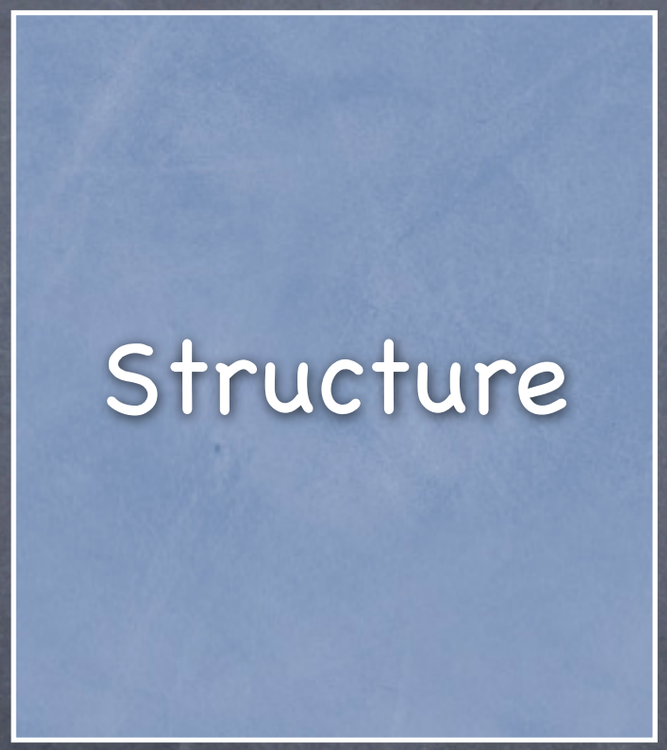


The Product

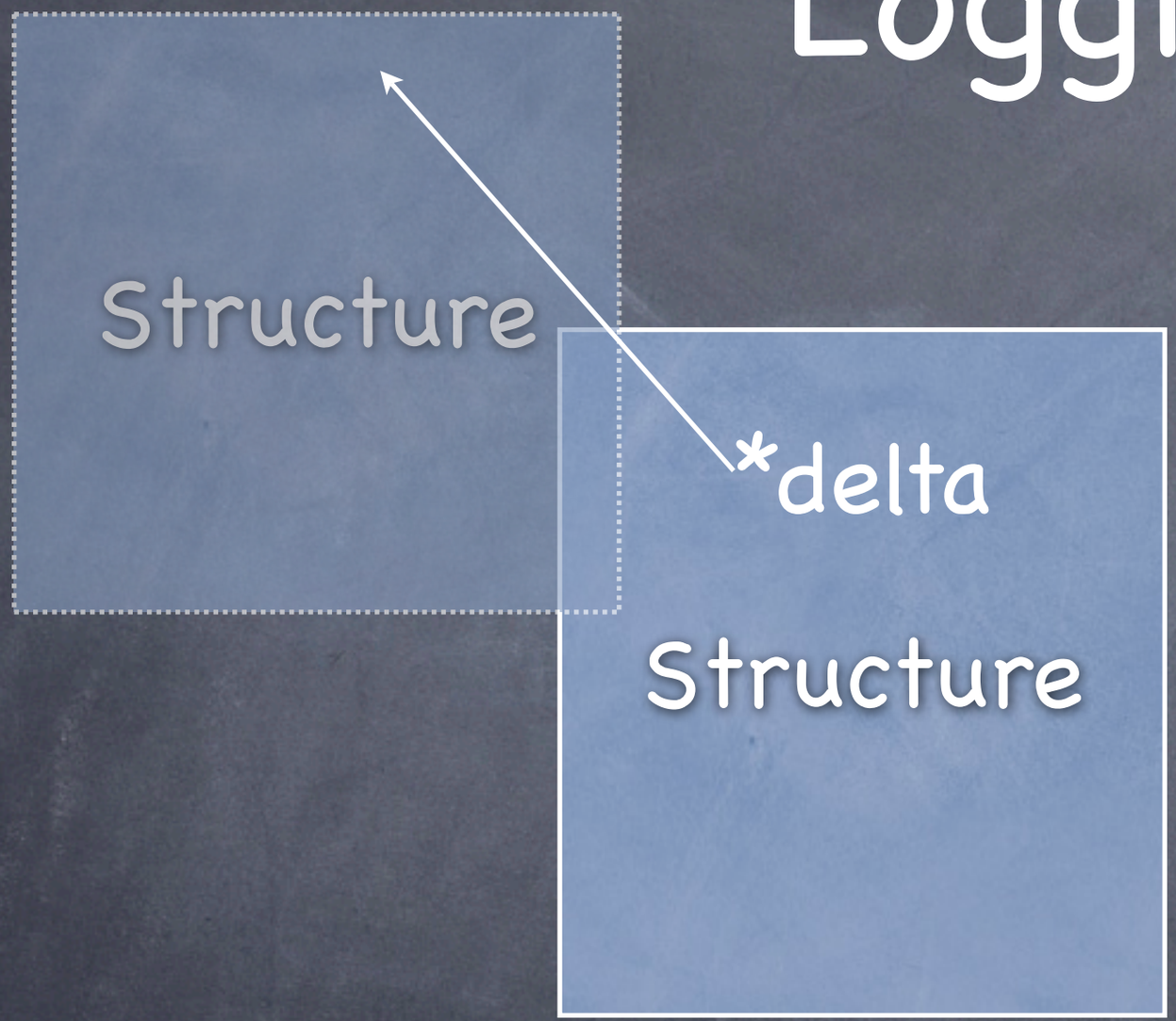

portal.tcl
compt.tcl
node.tcl
link.tcl
prac.tcl
cstruct.tcl
cstruct.h
cstruct.c


KEEP YOUR FORK
There's Pie!

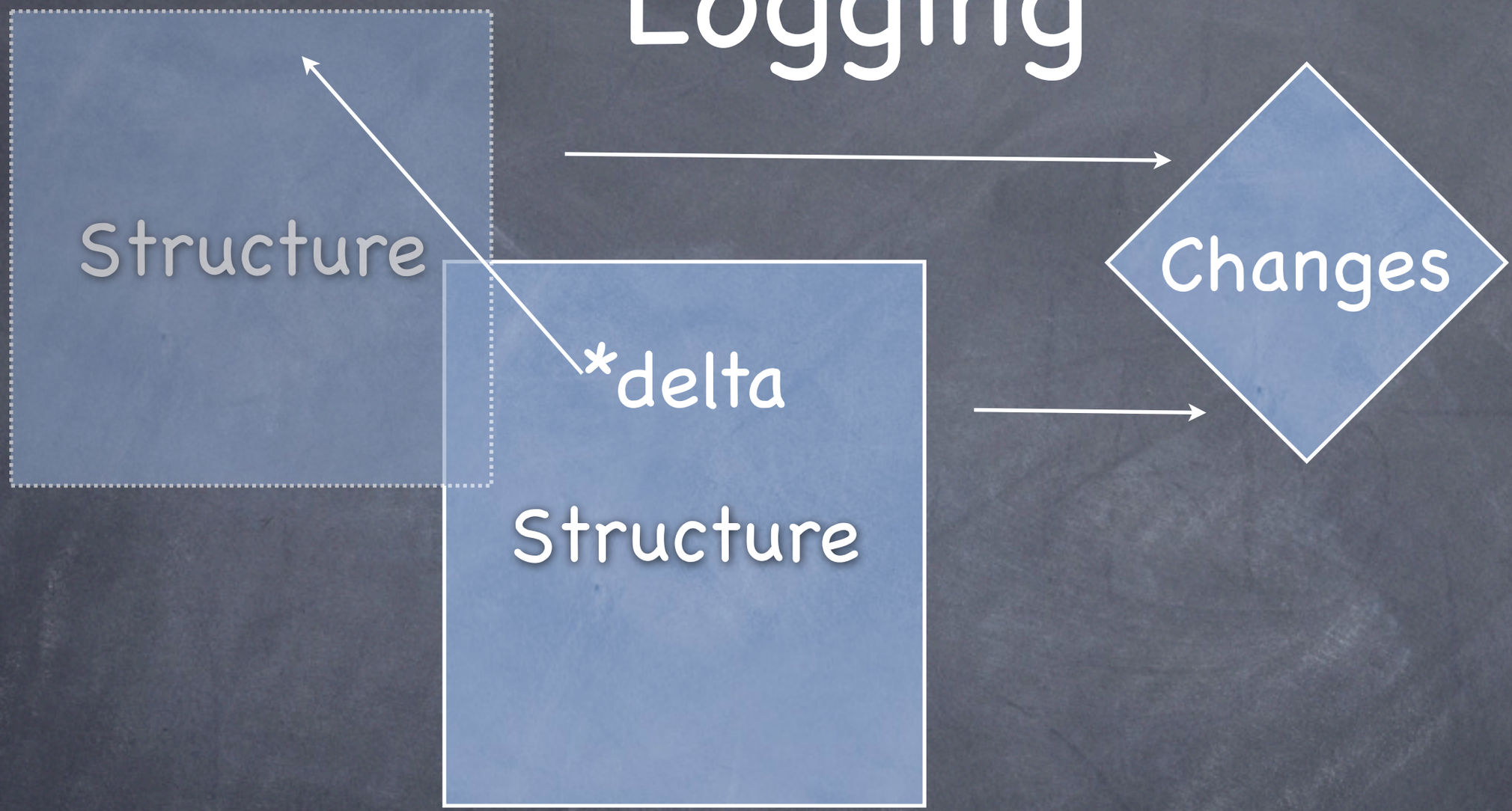
Logging



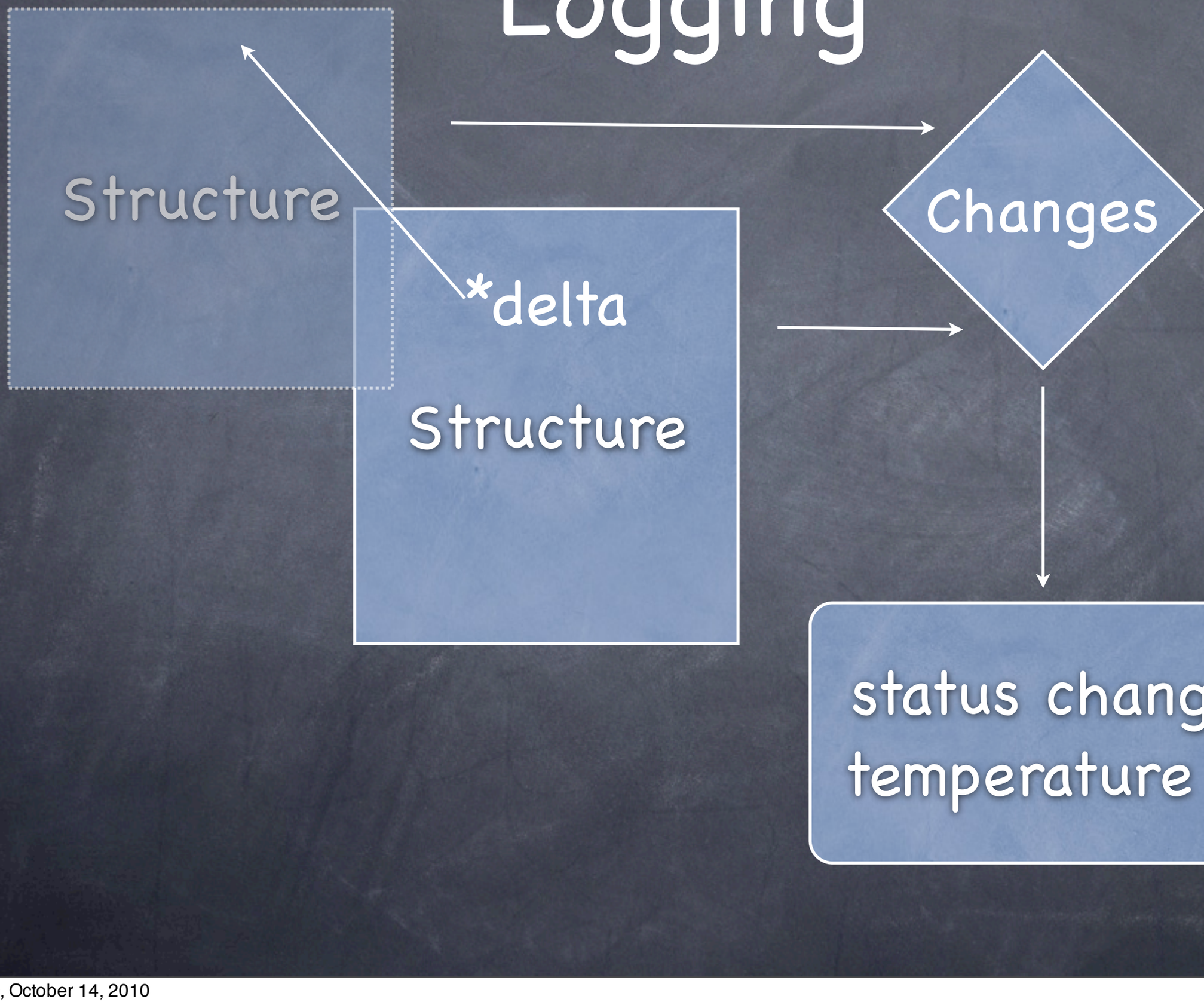
Logging



Logging



Logging


Structure
*delta
Structure
Changes
status changed
temperature 25

Property Inheritence

Type

size: 1x5x9ft

Node

size: 1x5x9ft

Demo