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DaFlEx

C2DaCe challenges

- **Classes**
  - Inheritance
  - Contexts
- **Recursions**
  - Tail recursion
  - Indirect recursion
- **Pointers**
  - Unrestrictred arithmetic
- **Stateful library calls**
  - Automatic assessment
- **Template programming**
- **Library nodes**
- **Encapsulation**

F2DaCe challenges

- **Generalized views**
- **Vector operations**
- **Labels & GoTo's**
- **Intrinsic function coverage**
- **Modern Fortran**

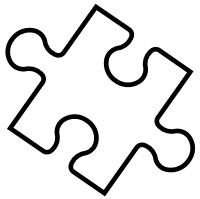
DaCe challenges

- **Application-level ToGPU transform**
  - + Associated transforms

Engineering efforts

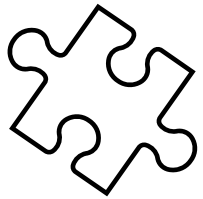
Research efforts

Application-level ToGPU transform



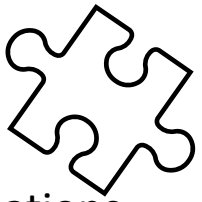
Map Fission

- On any SDFG
- Must handle
  - Edge assignments
  - Scalars
  - Control flow



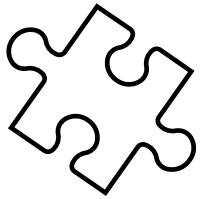
Map Fusion

- On any pair of Maps
- Must accept
  - Conditions
- Needs helper Transformations



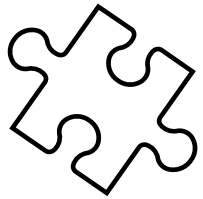
Map to GPU 35%

- Must work on arbitrary Maps
- Not a state-level transformation



Performance heuristics

- Guide SDFG transformations
- Must handle
  - Application requirements
  - Hardware capabilities



Data instrumentation

- Simplifies debugging
- Allows faster heuristics development

Analysis and performance discoveries.

```
DO JK=1,KLEV
  DO JL=KIDIA,KFDIA
    IF (ZQX(JL,JK,NCLDQL)+ZQX(JL,JK,NCLDQI)<RLMIN.OR.ZA(JL,JK)<RAMIN) THEN
      ZLNEG(JL,JK,NCLDQL) = ZLNEG(JL,JK,NCLDQL)+ZQX(JL,JK,NCLDQL)
      ZQADJ               = ZQX(JL,JK,NCLDQL)*ZQTMST
      tendency_loc_q(JL,JK)        = tendency_loc_q(JL,JK)+ZQADJ
      tendency_loc_T(JL,JK)        = tendency_loc_T(JL,JK)-RALVDCP*ZQADJ
      ZQX(JL,JK,NCLDQV)   = ZQX(JL,JK,NCLDQV)+ZQX(JL,JK,NCLDQL)
      ZQX(JL,JK,NCLDQL)   = 0.0

    ENDIF
  ENDDO
ENDDO
```

```
DO JM=1,NCLV-1
  DO JK=1,KLEV
    DO JL=KIDIA,KFDIA
      IF (ZQX(JL,JK,JM)<RLMIN) THEN
        ZLNEG(JL,JK,JM) = ZLNEG(JL,JK,JM)+ZQX(JL,JK,JM)
        ZQADJ               = ZQX(JL,JK,JM)*ZQTMST
        tendency_loc_q(JL,JK)        = tendency_loc_q(JL,JK)+ZQADJ
        IF (IPHASE(JM)==1) tendency_loc_T(JL,JK) = tendency_loc_T(JL,JK)-RALVDCP*ZQADJ
        IF (IPHASE(JM)==2) tendency_loc_T(JL,JK) = tendency_loc_T(JL,JK)-RALSDCP*ZQADJ
        ZQX(JL,JK,NCLDQV)   = ZQX(JL,JK,NCLDQV)+ZQX(JL,JK,JM)
        ZQX(JL,JK,JM)       = 0.0
      ENDIF
    ENDDO
  ENDDO
ENDDO
```

Analysis and performance discoveries.

```
  DO IBL=1,512
      JKGLO=(IBL-1)*NPROMA+1
      ICEND=MIN(NPROMA,NGPTOT-JKGLO+1)

      !-- These were uninitialized : meaningful only when we compare error differences
      !PCOVPTOT(:,:,IBL) = 0.0
      !tendency_loc_cld(:,:,NCLV,IBL) = 0.0

      CALL CLOUDSC(1,    ICEND,    KLON,    KLEV,&
```

```
SUBROUTINE CLOUDSC&
 !---input
 & (KIDIA,    KFDIA,    KLON,    KLEV,&
….
REAL(KIND=JPRB) :: Z_TMP1(KFDIA-KIDIA+1)
REAL(KIND=JPRB) :: Z_TMP2(KFDIA-KIDIA+1)
REAL(KIND=JPRB) :: Z_TMP3(KFDIA-KIDIA+1)
REAL(KIND=JPRB) :: Z_TMP4(KFDIA-KIDIA+1)
```