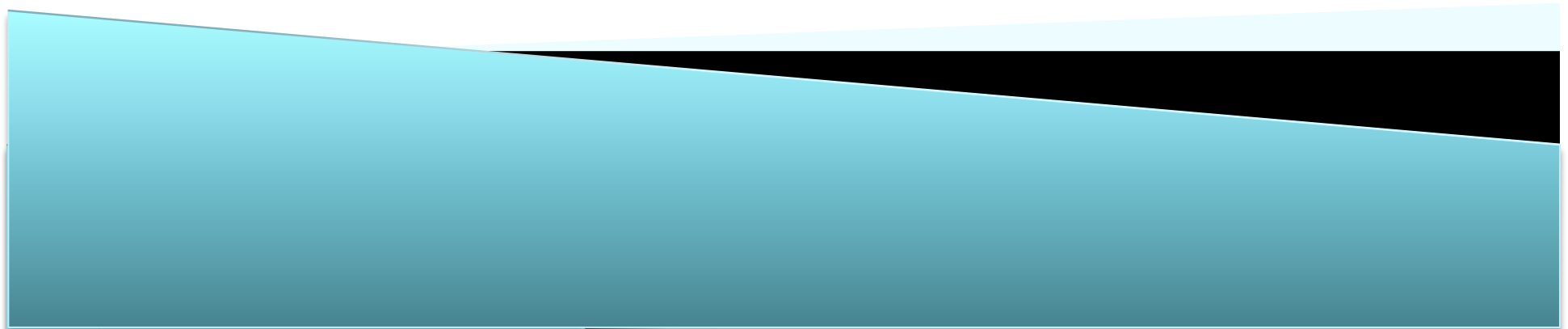

te~~xt~~t

TEXT – *Towards EXaflop*
Applications



TEXT: Towards Exaflop Applications

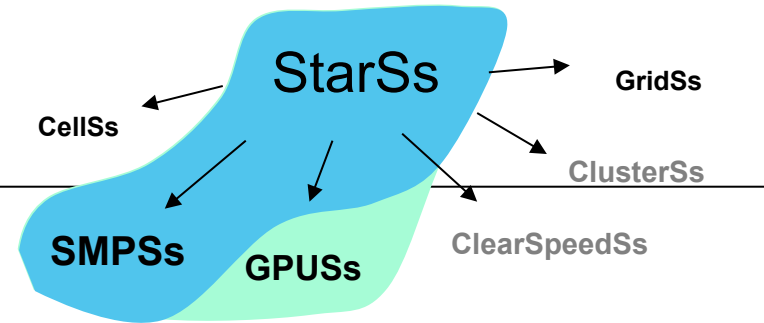
▶ Objective

- Demonstrate the benefits of the hybrid MPI/StarSs programming model
- On a rich set of applications → deployed and used
- **To accelerate impact and takeup**
- **Position Europe towards Exaflop on key software infrastructure technologies: programmability, efficiency and applications**

▶ Addressing topics of the call:

- Scientific software @ dynamically evolving platforms
 - Seven applications from five different areas, with large community of users behind:
 - Linear Algebra: HLA (UNIMAN, UJI) ✓ PRACE benchmarks
 - Geophysics: SPECFEM3D (UPPA) ✓
 - Plasma physics: PSC, PEPC (Juelich) ✓
 - Molecular dynamics: CPMD (IBM) ✓ , LS1 MarDyn (USTUTT)
 - Engineering: BEST (USTUTT)
- Infrastructure
 - Programming model is key → hybrid MPI/StarSs
 - Increased Productivity, portability and efficient exploitation of dynamically evolving hardware platforms.
 - Debug and performance tools
- Standards
 - Promote StarSs ideas towards OpenMP4.0

StarSs: productivity and performance



- Single source any target
- Asynchronous data-flow execution
- Overlap communication/computation
- Automatic lookahead

```

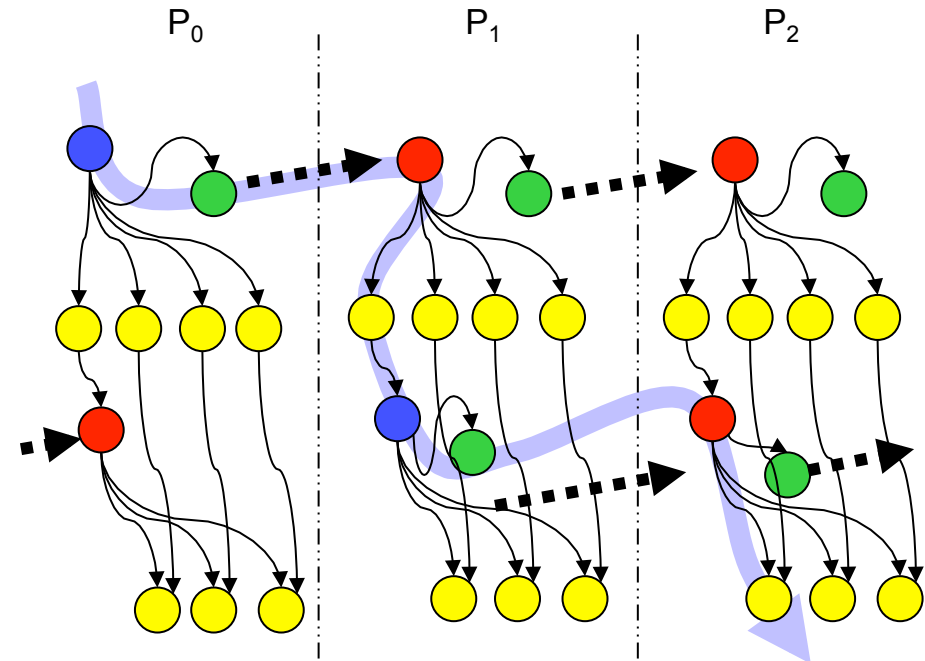
...
for (k=0; k<N; k++) {
  if (mine) {
    Factor_panel(A[k]);
    send (A[k])
  } else {
    receive (A[k]);
    if (necessary) resend (A[k]);
  }
  for (j=k+1; j<N; j++)
    update (A[k], A[j]);
...

```

```

#pragma css task inout(A[SIZE])
void Factor_panel(float *A);
#pragma css task input(A[SIZE]) inout(B[SIZE])
void update(float *A, float *B);

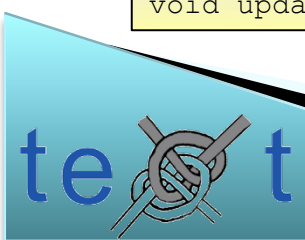
```



```

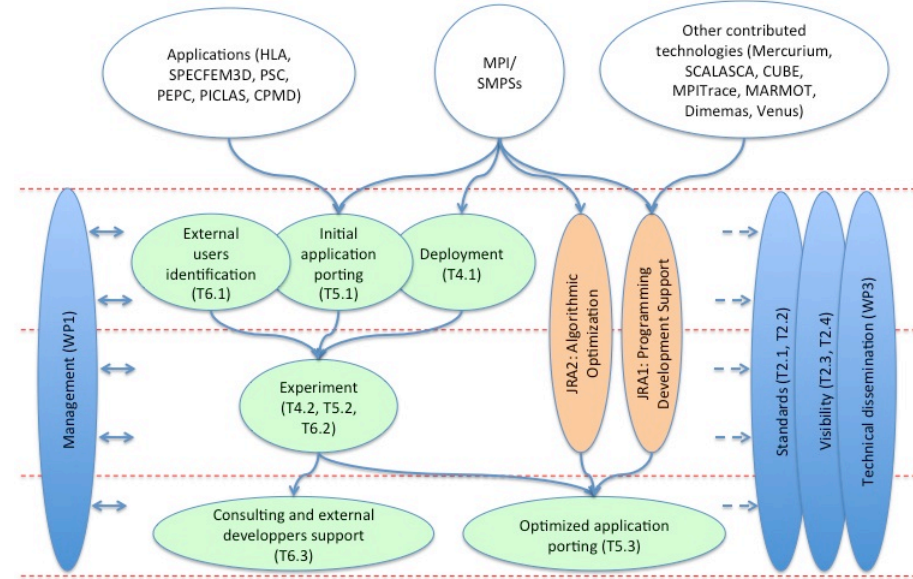
#pragma css task input(A[SIZE])
void send(float *A);
#pragma css task output(A[SIZE])
void receive(float *A);
#pragma css task input(A[SIZE])
void resend(float *A);

```

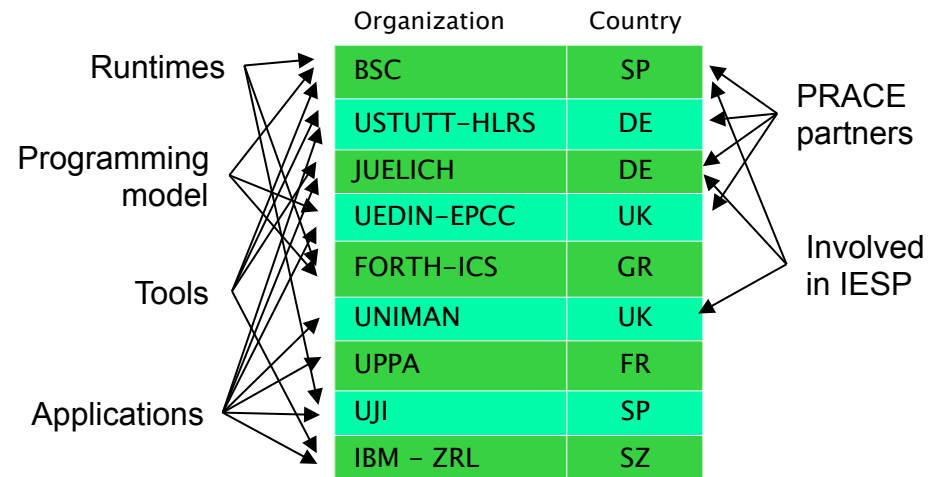


TEXT: structure

- ▶ **NA**
 - Management, Standards, Dissemination
- ▶ **SA**
 - Deploy, Port apps, External users
- ▶ **JRA**
 - Program development support
 - Runtime & Algorithmic optimization



- ▶ Well-balanced team of research institutions, HPC centers and an industry research laboratory
- ▶ Partners selected because of their service and research background experience
- ▶ HPC centers in the project deeply committed in PRACE.



Text resources

- ▶ Effort: 356 PMs
- ▶ Budget: 3,459,528 Euros
- ▶ EC contribution: 2,470,000 Euros

- ▶ Four HPC centers providing infrastructure: Juelich, HLRS, BSC and EPCC

- ▶ Software provided by partners:
 - **Applications**
 - Programming model: StarSs –SMPSs, GPUSs– (BSC)
 - Performance Tools: CUBE/Scalasca (Juelich), CEPBA tools (BSC), Venus (IBM)
 - Debugger: Marmot (HLRS)