Trading Latency for Composability

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Simulink vs Giotto Semantics

- **RTW (Simulink)**
  fast to slow connection

- **LET (Giotto)**
  every connection

- **Sequence of n tasks**
  RTW latency up to n times smaller

"Trading Latency for Composability", S. Matic
Composable Real-time Systems

• Real-time assurance + Flexibility
  - hierarchical scheduling frameworks

• Independent task group abstraction
  - periodic resource model \((P,C)\)
    • guarantees \(C\) units in every \(P\) units

• Task precedence graphs
  - intragroup, intergroup, distributed precedence
Intragroup Abstraction

• Task precedence within group, single resource
• Function $c_S$ tightly abstracts $G$ if
  $c_S(P)$ is smallest $C$ s.t. $G$ is schedulable with $S$ under $(P,C)$
  - smaller $c_S$ ! tighter abstraction ! better composability

For each $G$ and $P$

$$c_{RTW}(P), c_{LET}(P)$$
Distributed / Intergroup Abstraction

- Distributed task graph over m resources
  - There exist G and P
  
  \[ c_{RTW}(P) - c_{LET}(P) \geq (m-1)P \]

- Task precedence between groups
  - hierarchical task graph

  ➢ LET compositional \((c_j \neq c)\)
  - RTW not compositional