

Optimization Framework and Protocol

maximize $\sum_{m \in M} U_m(\{x_s^{rec}\}_{s \in set(m)}) - \delta \sum_{\forall nodes, k} P_{tot}^k$

subject to

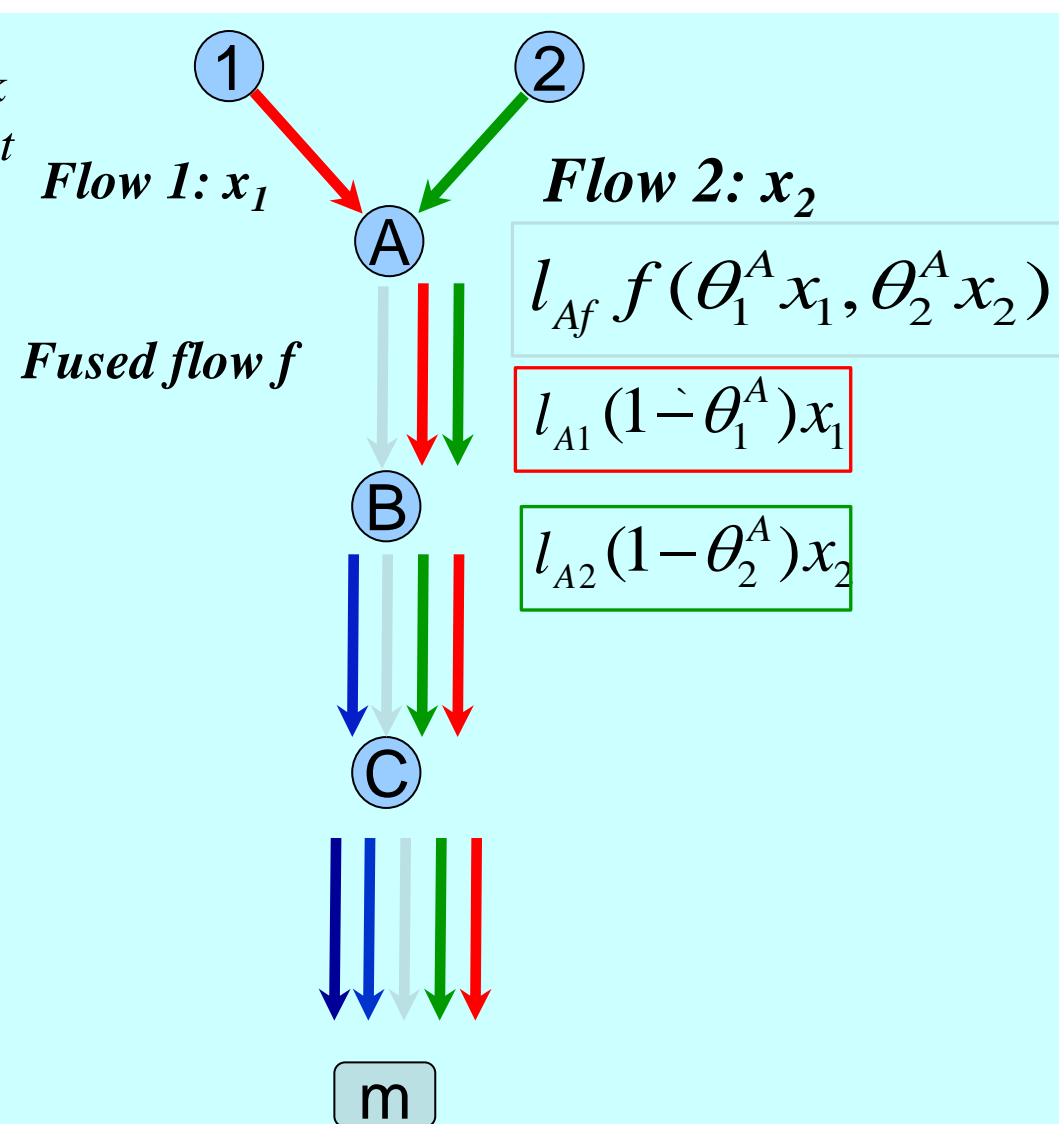
i) Capacity constraint :

$$\sum_{\forall (k,i) \in q} \frac{x_{out}(i,k)}{C_{ki}} \leq 1, \forall q \in Q$$

ii) Energy constraint :

$$P_{tot}^k \leq P_{max}^k, \forall nodes, k$$

where $P_{tot}^k = P_{rec}^k + P_{trans}^k + P_{comp}^k$

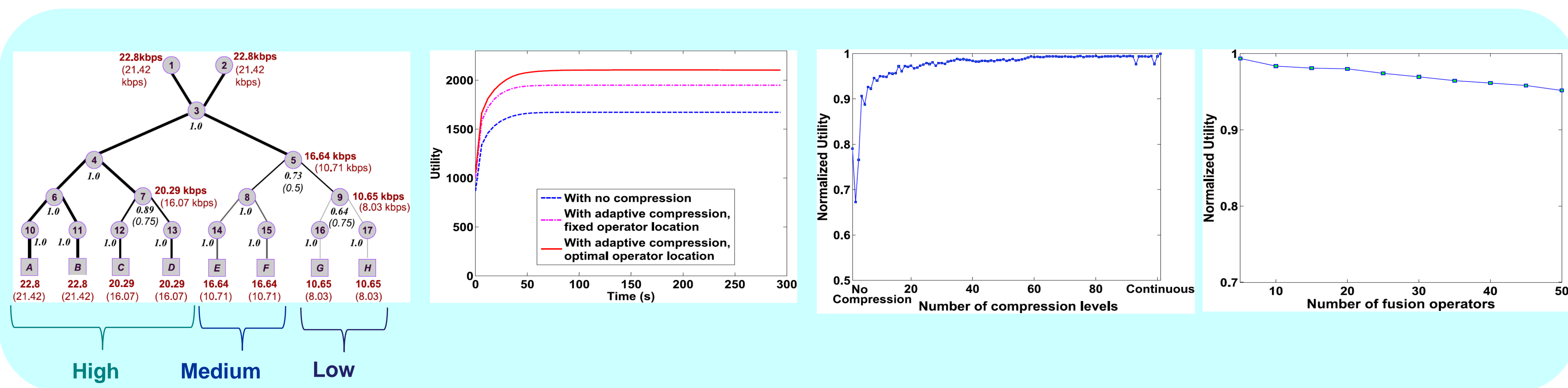


$$\frac{dx_s}{dt} = \kappa x_s \left(\sum_{m \in Miss(s)} \frac{\partial U_m}{\partial x_s} - \sum_{\forall k} (\delta + \eta_k) \frac{\partial P_{tot}^k}{\partial x_s} - \sum_{\forall q} \mu_q \sum_{\forall (k,s) \in q} \frac{\partial x_{out}(s,k)}{C_{ks} \partial x_s} \right)$$

$$\frac{dl_{ki}}{dt} = \kappa l_{ki} \left(\sum_{m \in Miss(i)} \frac{\partial U_m}{\partial l_{ki}} - \sum_{\forall v} (\delta + \eta_v) \frac{\partial P_{tot}^v}{\partial l_{ki}} - \sum_{\forall q} \mu_q \sum_{\forall (v,i) \in q} \frac{\partial x_{out}(i,v)}{C_{vi} \partial l_{ki}} \right)$$

$$\frac{d\theta_{op,s}^k}{dt} = \kappa \theta_{op,s}^k \left(\sum_{m \in Miss(i)} \frac{\partial U_m}{\partial \theta_{op,s}^k} - \sum_{\forall v} (\delta + \eta_v) \frac{\partial P_{tot}^v}{\partial \theta_{op,s}^k} - \sum_{\forall q} \mu_q \sum_{\forall (v,i) \in q} \frac{\partial x_{out}(i,v)}{C_{vi} \partial \theta_{op,s}^k} \right)$$

Simulation Results



Conclusion and Future work

- Protocol for adaptive compression and fusion placement
 - Fully distributed
 - Low overhead
 - Provably optimal utilization of bandwidth and energy
- Heuristics for realistic constraints provide near-optimal solution
- In future, we will develop a model taking lifetime requirements of mission
- Published at IEEE/ACM DCSS 2009.

Acknowledgement

This research was sponsored by US Army Research laboratory and the UK Ministry of Defence and was accomplished under Agreement Number W911NF-06-3-0001. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the US Army Research Laboratory, the U.S. Government, the UK Ministry of Defense, or the UK Government. The US and UK Governments are authorized to reproduce and distribute reprints for Government purposes notwithstanding any copyright notation hereon.