Communication and Computation Infrastructure for Challenged Environments

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Networking @ IU

- Indiana University is home to the GlobalNOC, the operational partner for many national and international research and educational networks
- International Networks operates many international links with various collaborations in Polar Research
- The new department of Intelligent Systems Engineering is beginning to offer a Master’s degree in Network Engineering
- Many opportunities for collaboration
  - This talk will focus on my group’s work…
OPeN @ IU

• Open Programmable Networks (OPeN) focuses on technologies for improving communication performance
  • Performance in terms of time, utilization, power…
• Programmable, service rich networks
  • Software Defined Networks
  • Network microservers and services
• Particular focus on challenged environments
  • This is when it pays to be efficient!
The Data Logistics Toolkit

• Logistics – time sensitive positioning of materials
• Data Logistics exposes primitive storage elements that can be configured in a variety of ways
  • Caches or burst buffer
  • Content distribution
  • Content replication
  • Delay/Disruption Tolerant networking
• Simple, composable storage in the network
WildfireDLN

**WildfireDLN Key Features:**
1. Reduced data access barriers
2. Multiple distribution modes in dynamic, mobile environments
3. Resilient in the face of frequently disconnected networks
InLocus - Data Distillation at the Edge

• Streaming timeseries data is an important use case
• In-network processing can reduce data volume
  • We use edge to mean the edge of the network
• We want a flexible “bump in the wire” that can be relocated based on various criteria
• Use the Apache Storm / Twitter Heron model
  • Streaming data with Spouts (streams)
  • and Bolts (functions)
We assert that Linux+Docker is unnecessarily heavyweight.
Phoebus - Network Acceleration

- Addresses issues related to TCP in wide area networks
  - Splicing
  - Protocol translation
  - Path steering
  - Compression

$BW = \frac{mss}{rtt \sqrt{p}} \times C$
Flange and UNIS

• UNIS discovers and stores network topology
• The network is represented as a graph over which we can reason about service placement, alternate routing choices and network configuration
Flange

- Flange allows expression of flow behaviors
  - Software defined routing rules
  - Data compression/encryption
  - Stream processing
  - Opportunistic network connections
OPeN @ IU

• A variety of network and system-related tools that could be beneficial for challenged environments
• Let’s discuss collaboration opportunities!