Resilient System Solutions for Data in Wildland Fire Incident Operations
Development of the Wildland-fire Data Logistics Network

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Project Goal

To enhance and extend current operational data sharing capabilities for:

- Improved firefighter and public safety
- Better wildland fire predictions
- More informed fire operations

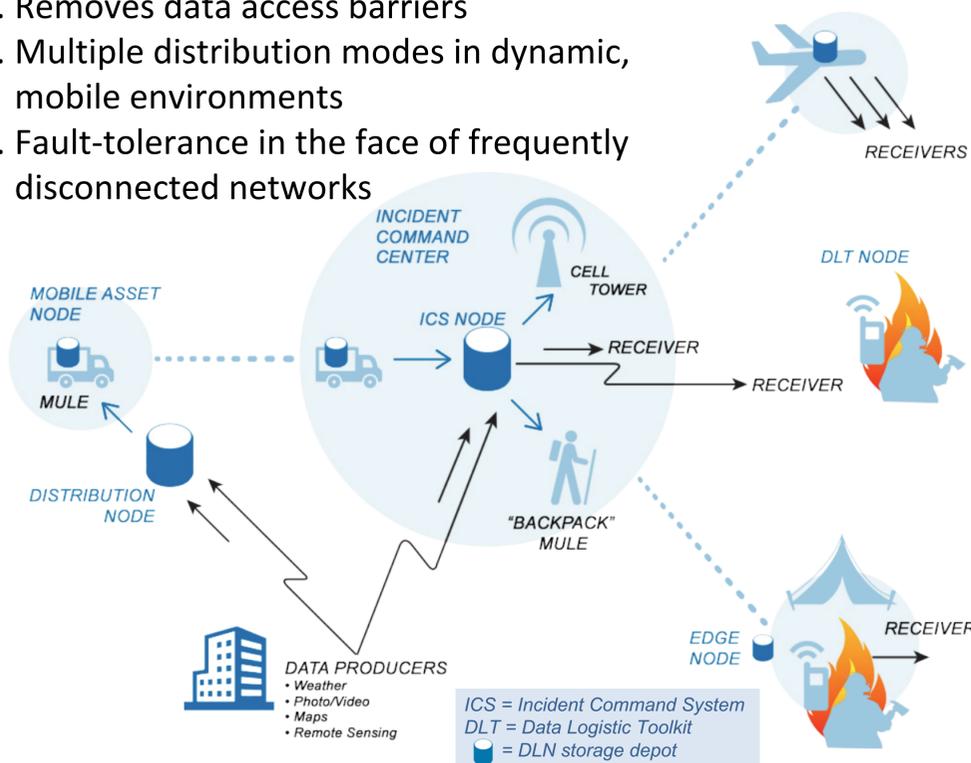Landsat image of the 2016 Fort McMurray Fire in Alberta, Canada
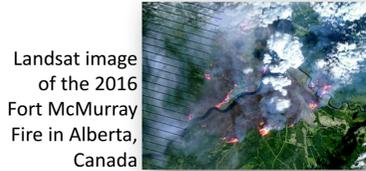
Problem Statement

Wildland firefighting operations are regularly obstructed by the construction and maintenance of ad hoc communication networks.

As a result, incident command decisions and wildfire containment are delayed.

Environmental impact
Injury and death
Property damage
Poor network coverage and data portability

Excessive post-fire erosion from the Hayman Fire (Photo by Mary Ellen Miller)

System Overview

WildfireDLN key features:

1. Removes data access barriers
2. Multiple distribution modes in dynamic, mobile environments
3. Fault-tolerance in the face of frequently disconnected networks

MOBILE ASSET NODE
MULE
DISTRIBUTION NODE
INCIDENT COMMAND CENTER
ICS NODE
CELL TOWER
RECEIVER
RECEIVER
RECEIVERS
"BACKPACK" MULE
DLT NODE
EDGE NODE
RECEIVER
DATA PRODUCERS
• Weather
• Photo/Video
• Maps
• Remote Sensing

ICS = Incident Command System
DLT = Data Logistic Toolkit
= DLN storage depot

Local operation – decentralized federation of available nodes and connected devices

Dynamic architecture that operates over intermittently connected and heterogeneous networks

Logistical data distribution – managed workflows for prioritizing and filtering data of importance over geographic and/or temporal criteria

Mobile Apps | Admin Portals | Routing Algos | Workflow MGMT

LoRS – Logistical Runtime System
LoDN – Logistical Distribution Network
IDMS – Intelligent Data Movement Service
Periscope – Network topology and measurements via UNIS (database)

Data Logistics Toolkit (DLT) library

LoRS | LoDN | IDMS | Periscope/UNIS

http://data-logistics.org
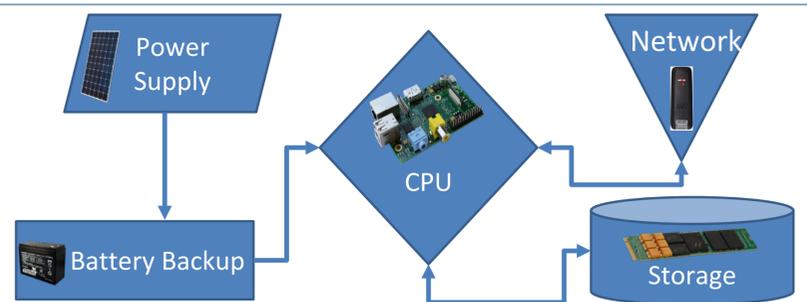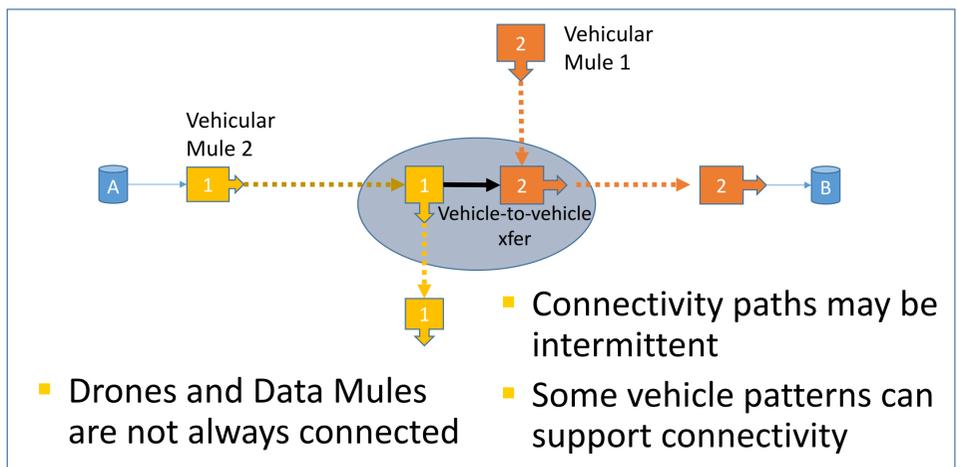
Wildland-fire Incident Command Center Support

National Interagency Fire Center

An aerial view of the Lolo Creek Fire Incident Command Post (ICP) in Lolo, Montana. This particular ICP is the temporary home of 794 fire personnel. (U.S. Forest Service photo)

Objectives

Deploy and test prototype hardware-software system with fire operations personnel that integrates the new data sharing system with existing capabilities and relevant data.

Co-develop software systems for data logistics based on existing tools, including future proofing and generation of ideas to advance capabilities with further R&D.

Work with the wildland fire management community to define specific requirements of an enhanced, resilient data sharing system.
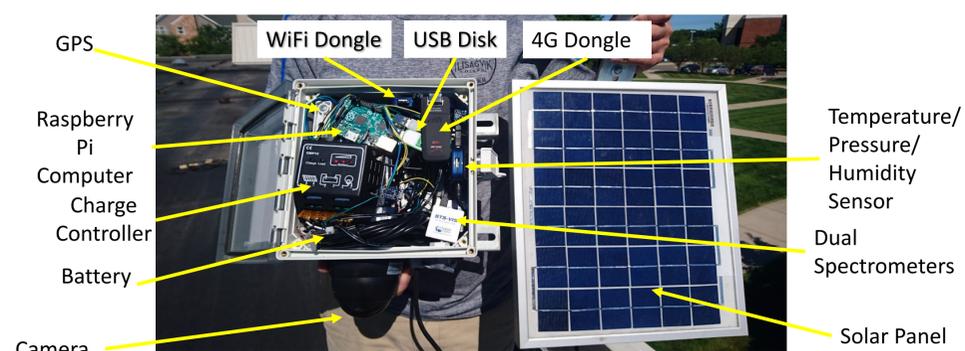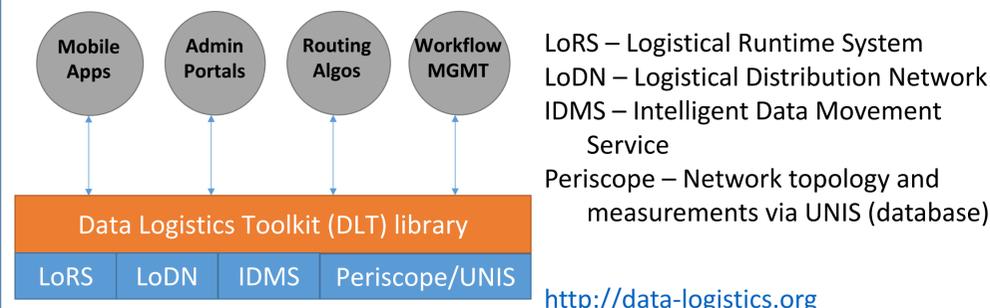

Vehicular Mule 2
Vehicular Mule 1
Vehicle-to-vehicle xfer
A → B

- Connectivity paths may be intermittent
- Some vehicle patterns can support connectivity
- Drones and Data Mules are not always connected

Power Supply
Battery Backup
CPU
Storage
Network

Hardware Options (mix and match)

Power	CPU	Network	Storage
Battery Always – various sizes	*Anything Linux*	• WiFi	• USB drive
• Utility	• Raspberry Pi	• 4G	• Hard Drive
• Generator	• Beaglebone	• Bluetooth	• SD Card
• Solar	• BRCK	• Ethernet	• Server Rack
• Wind	• PC		
	• Rack Server		

GPS
WiFi Dongle | USB Disk | 4G Dongle
Raspberry Pi Computer
Charge Controller
Battery
Camera
Temperature/Pressure/Humidity Sensor
Dual Spectrometers
Solar Panel

Example of existing compact system – similar to a potential "backpack" (portable) version of a depot node