



Towards a Software-Defined Farm

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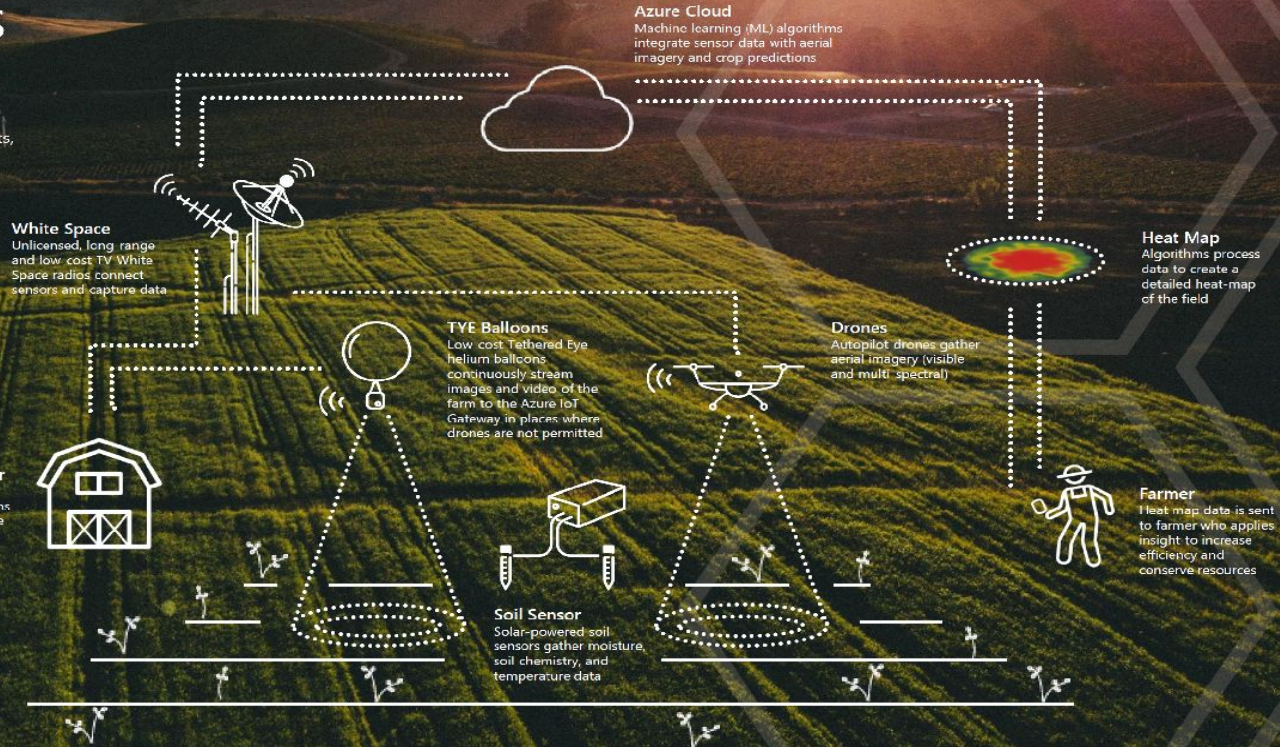
Feeding 10 billion in 2050: Man vs Machine

- Increase agricultural total factor productivity (TFP)
 - by 2% per year from 1.5%?
- Reduce crop loss to env stress, disease, insects, etc
 - ... by 20%
- Improve water-N-P use efficiency
 - by 50%

Feeding 10 billion in 2050: Man vs Machine

FarmBeats

FarmBeats provides farmers with access to the Microsoft Cloud and AI technologies, enabling data-driven decisions to help improve agricultural yield, lower overall costs, and reduce the environmental impact of agricultural production.





Research Questions

1. What are the right abstractions to underpin innovation in digital agriculture?
2. Is it possible to innovate while keeping IoT platforms equitable?

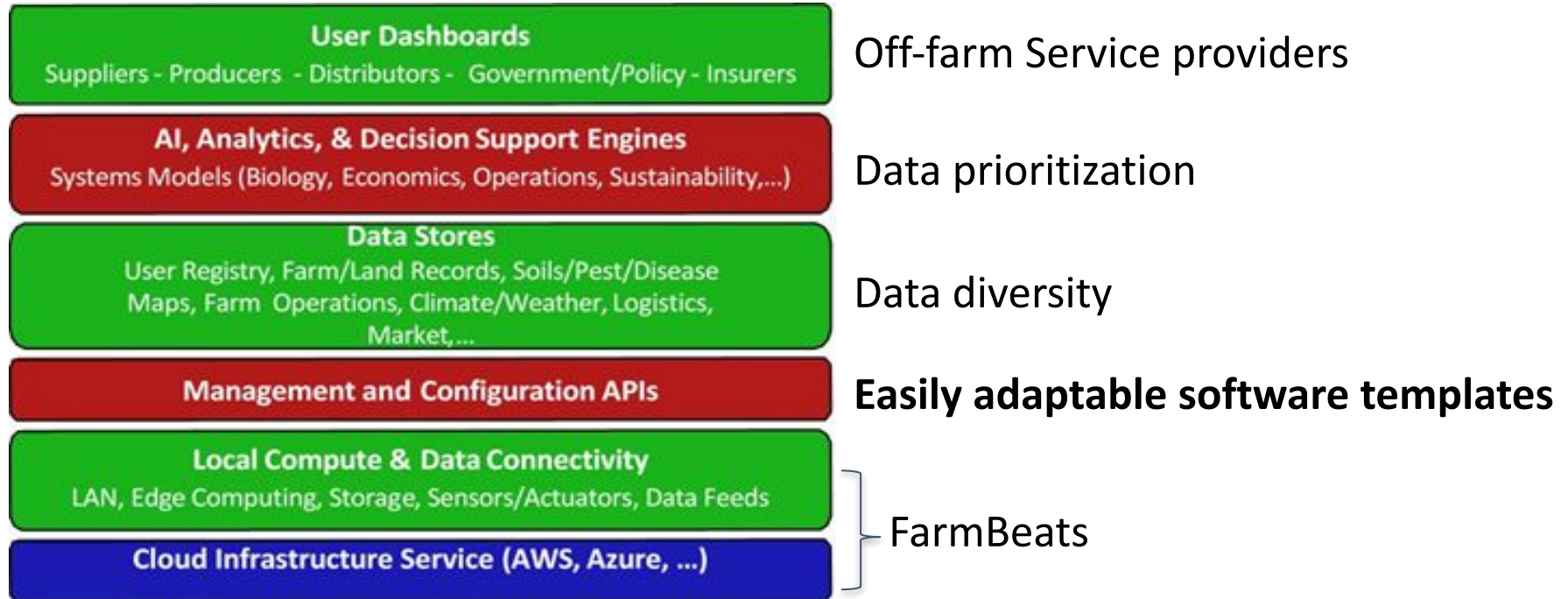


Roadmap

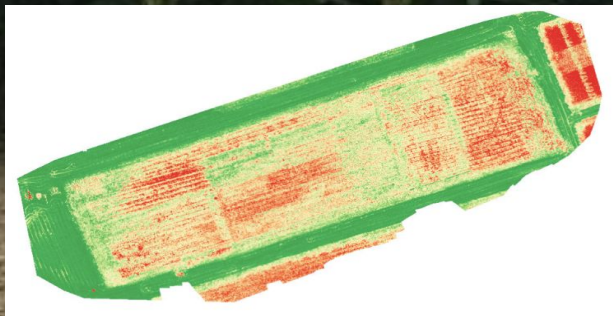
- Technical approach
 - Software-Defined Farm
- Social approach

Towards a Software-Defined Farm (SDF)

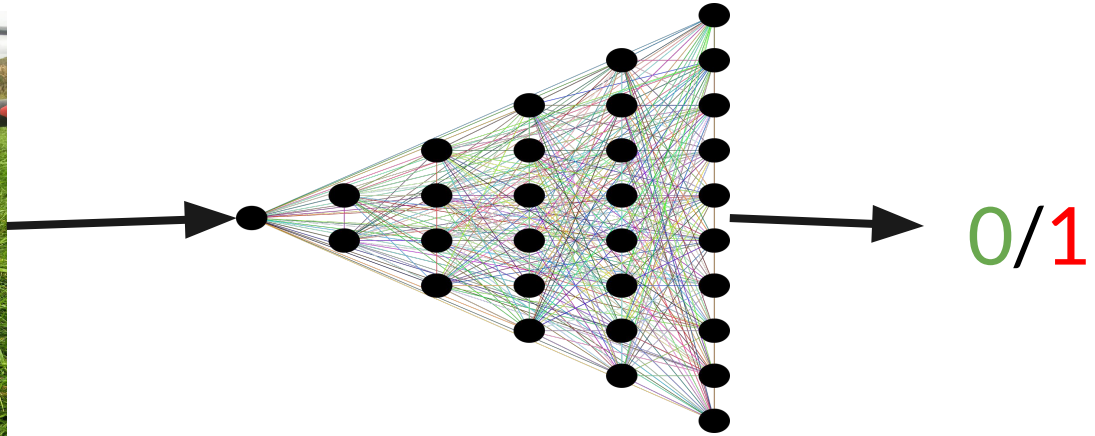
Sense + Data + Comm + Cloud + Analytics + Actuation = SDF



Mike Gore Lab: Identifying Northern Corn Leaf Blight



Identifying Northern Corn Leaf Blight (NCLB)

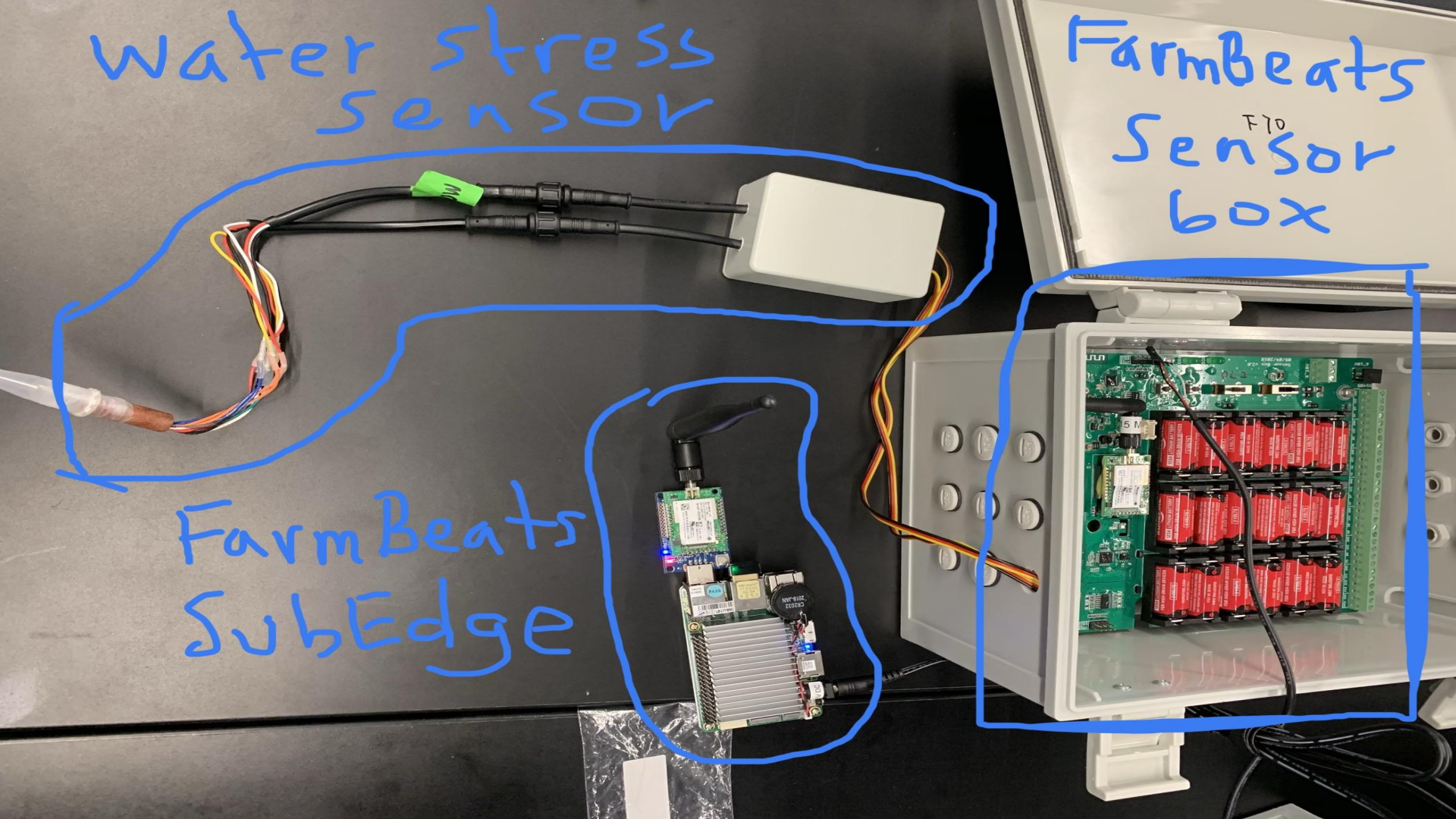


Abe Stroock Lab: Modeling Plant Water Stress

Water stress
sensor

FarmBeats
Sensor
box

FarmBeats
SubEdge



Data Management & Processing Plan

Data stream A

Location: cloud-company server
Type of data: attached sensor
Units: X min/h, Y min/h
Collection frequency: every 2 h

Data stream B

Location: farm PC
Type of data: non-attached sensor
Units: lbs/session, % of X/session, % of Y/session
Collection frequency: session

Data stream C

Location: farm PC
Type of data: cow feature (e.g., age), single number stats (e.g., previous milk production)
Units: days, years, lbs,
Collection frequency: 1/lactation, >1/lactation

Algorithms and processes to transform data from A, B, C

Centralized data stream

ID	Date	Time	X	Y	Z	W	Q	K	
134	1/1	8:00	546	70	3.45	1	39.4	1.3	
134	1/1	10:00	500	75	3.23	1	39		
134	1/1	12:00	514	78	3.17	1	39.2		
546	1/1	8:00	523	91	3.56	3	38.7	1.8	
546	1/1	10:00	543	97	3.87	3	38.9		
546	1/1	12:00	567	98	3.56	3	39.5		
986	1/1	8:00	437	67	3.65	4	39.2	2.8	
986	1/1	10:00	445	76	3.40	4	39.2		

Machine Learning Algorithms and Non-Machine Learning equations

HSI alarms

Multiple parameter
(uses more than one sensor + one or more non-sensor parameters)

Single parameter
(uses one sensor parameter + one or more non-sensor parameter)



Roadmap

- Technical approach
 - Software Defined Farm
- Social approach

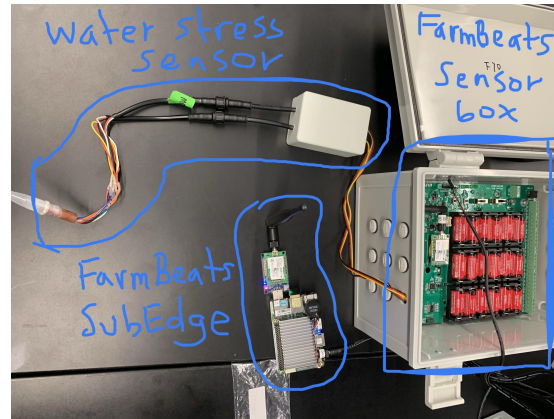
Social Approach



Conclusion



Reduce loss from disease



Water use efficiency



Increase productivity



Sources

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