AWS re:Invent

NOV. 29 – DEC. 3, 2021 | LAS VEGAS, NV

AIM207

AI/ML for sustainability innovation: Insight at the edge

Nelson González (he/him)
Head, Global Impact Computing
AWS

Mark Zimring (he/him)
Director, Large Scale Fisheries Program
The Nature Conservancy

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Agenda

Sustainability is a business priority

Addressing intersecting challenges with AI/ML

Data for insight – at the edge and at scale

Compute and AI/ML for sustainability

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Sustainability challenges are urgent and interconnected



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Our new leadership principle

Success and scale bring broad responsibility

We started in a garage, but we're not there anymore. We are big, we impact the world, and we are far from perfect. **We must be humble and thoughtful about even the secondary effects of our actions**. Our local communities, planet, and future generations need us to be better every day. We must begin each day with a determination to make better, do better, and be better for our customers, our employees, our partners, **and the world at large**. And we must end every day knowing we can do even more tomorrow. **Leaders create more than they consume and always leave things better than how they found them**.

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Committing to and investing in sustainability



On September 19, 2019, Amazon and Global Optimism announced The Climate Pledge, a commitment to meet the Paris Agreement 10 years early

- Net-zero carbon by 2040
- Path to 100% renewable energy by 2025
- $2 billion Climate Pledge Fund

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Sustainability drives business value

Risk mitigation ➡ Value creation



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Intersectionality

- Water access
- Wildfires
- Energy grid
- COVID-19
- Racial diversity/disparities
- Economic inequality
- Housing
- Transportation

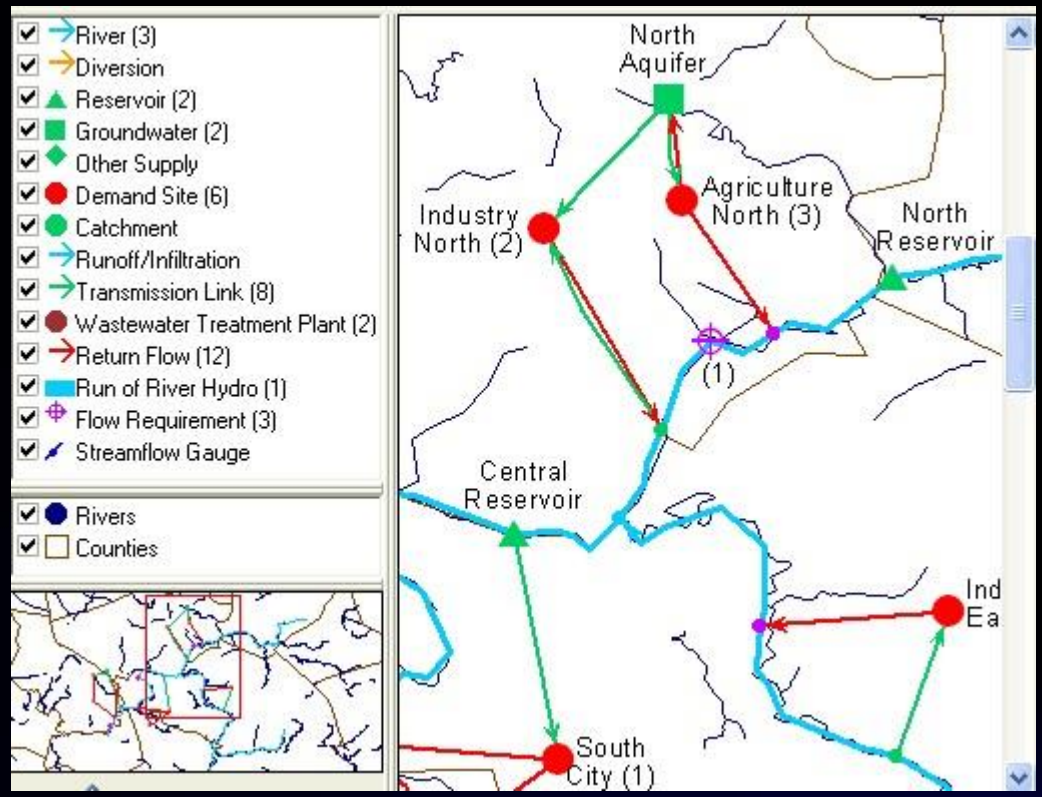


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Prediction in complex systems

SEI Stockholm Environment Institute

California water/energy grid analytics platform



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Sustainability data: Open data and commercial data

Open Data Program

Amazon Sustainability Data Initiative

AWS Data Exchange

Data to address a wide range of sustainability challenges



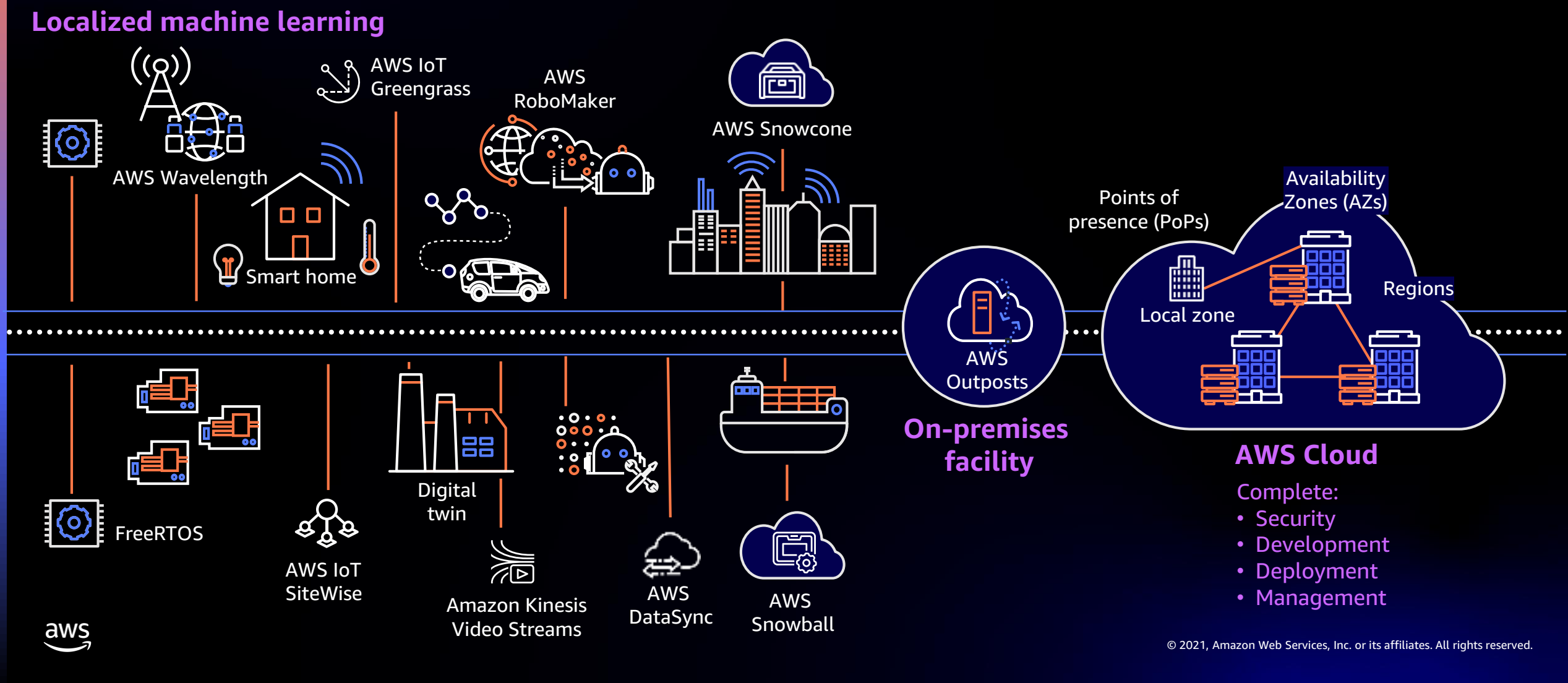
Image from Landsat 8 satellite, courtesy of the U.S. Geological Survey

Data proximity: Edge



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Disconnected and connected edge-to-cloud continuum



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Modern data architecture on AWS



Scalable data lakes

Purpose-built data services

Seamless data movement

Unified governance

Performant and cost-effective

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AI/ML for insight at the edge

AI services

Health AI
- Amazon HealthLake
- Amazon Transcribe Medical
- Amazon Comprehend Medical

Industrial AI
- AWS Panorama + appliance
- Amazon Monitron
- Amazon Lookout for Equipment
- Amazon Lookout for Vision

Anomaly detection
- Amazon Lookout for Metrics

Code and DevOps
- Amazon DevOps Guru
- Amazon CodeGuru

Vision
- Amazon Rekognition

Speech
- Amazon Polly
- Amazon Transcribe Medical

Text
- Amazon Comprehend Medical
- Amazon Translate
- Amazon Textract

Search
- Amazon Kendra

Chatbots
- Amazon Lex

Personalization
- Amazon Personalize

Forecasting
- Amazon Forecast

Fraud
- Amazon Fraud Detector

Contact centers
- Contact Lens for Amazon Connect
- Voice ID

ML services

- Amazon SageMaker
- Label data

SageMaker Studio IDE

Aggregate & prepare data | Store & share features | Auto ML | Spark/R | Detect bias | Visualize in notebooks | Pick algorithm | Train models | Tune parameters | Debug & profile | Deploy in production | Manage & monitor | CI/CD

SageMaker JumpStart

Human review

Model management for edge devices

Frameworks and infrastructure

- TensorFlow
- mxnet
- PyTorch
- GLUON
- Keras
- scikit learn
- Horovod
- DeepGraphLibrary
- AWS Deep Learning AMIs (DLAMI) and AWS Deep Learning Containers
- GPUs and CPUs
- Amazon Elastic Inference
- AWS Trainium
- AWS Inferentia
- FPGA

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AI/ML for sustainability

AWS impact computing



UN sustainable development goals

The social determinants of health



Healthy People 2030, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion

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Edge AI/ML for conservation innovation

Creating sustainable fisheries and supply chains through smart electronic monitoring

Mark Zimring (he/him)

Director, Large Scale Fisheries Program
The Nature Conservancy

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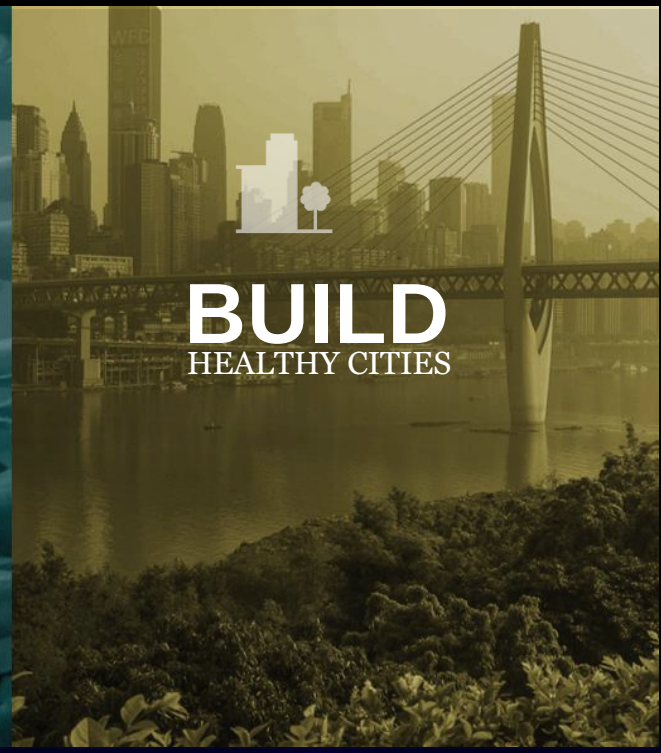
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At TNC, our priorities are guided by science, driven by urgency, and focused where our expertise can be a game changer.









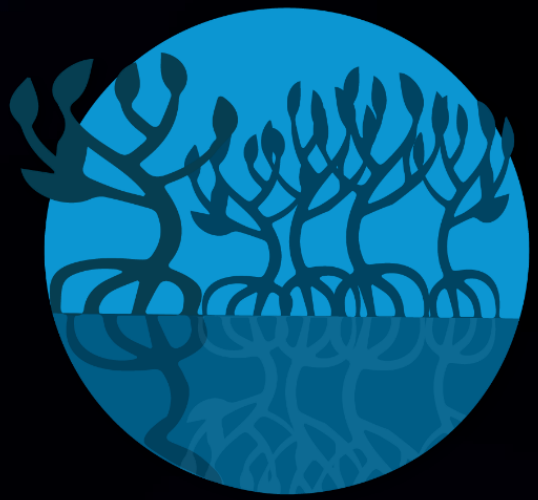
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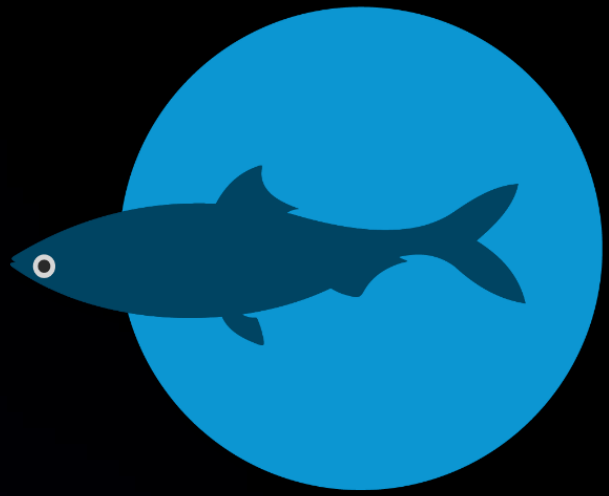
Our oceans are critical



90% of habitable space on the planet



50% of our oxygen



Food and income to **>3 billion people**

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Healthy fisheries are critical for healthy oceans

- Global fishing efforts cover 3x the geographic footprint of global agriculture
- 2/3 of global fisheries are either being overfished or are unable to sustain increased pressure



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We find the same challenge in fishery after fishery: Lack of data

Lack of monitoring

The vast majority of illegal, unreported, and unregulated (IUU) activity in fisheries occurs by licensed fishing vessels that are not reporting or underreporting catches

Most fisheries in the world lack reliable data about what happens on the water to inform and implement science-based management

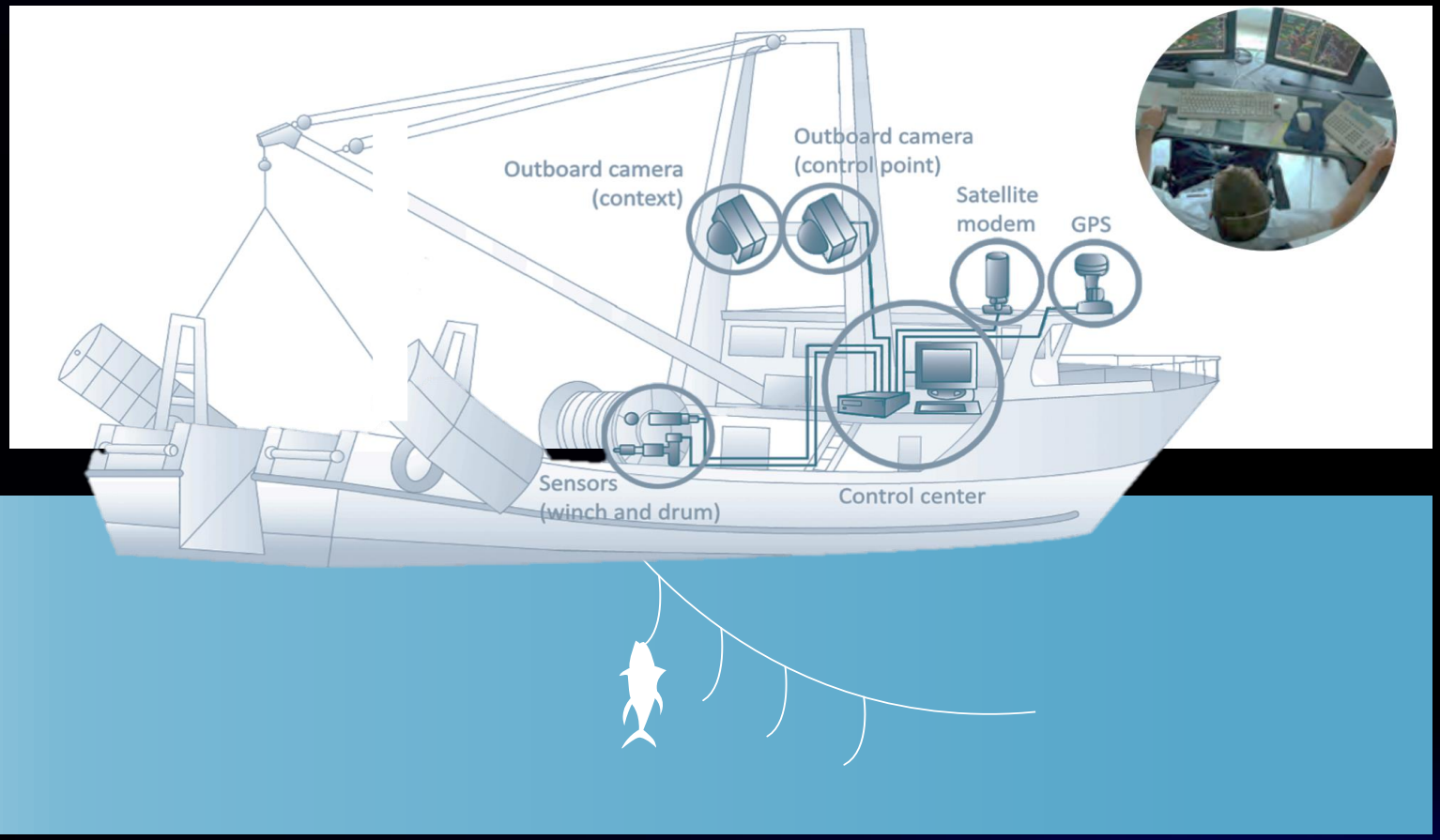
Lack of confidence

The status quo for supply chains and markets is low confidence in the basic legality and sustainability of seafood products

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Electronic monitoring closes these data gaps

Electronic monitoring (EM) is the use of onboard video cameras, GPS, and sensors to automatically track and verify fishing activity

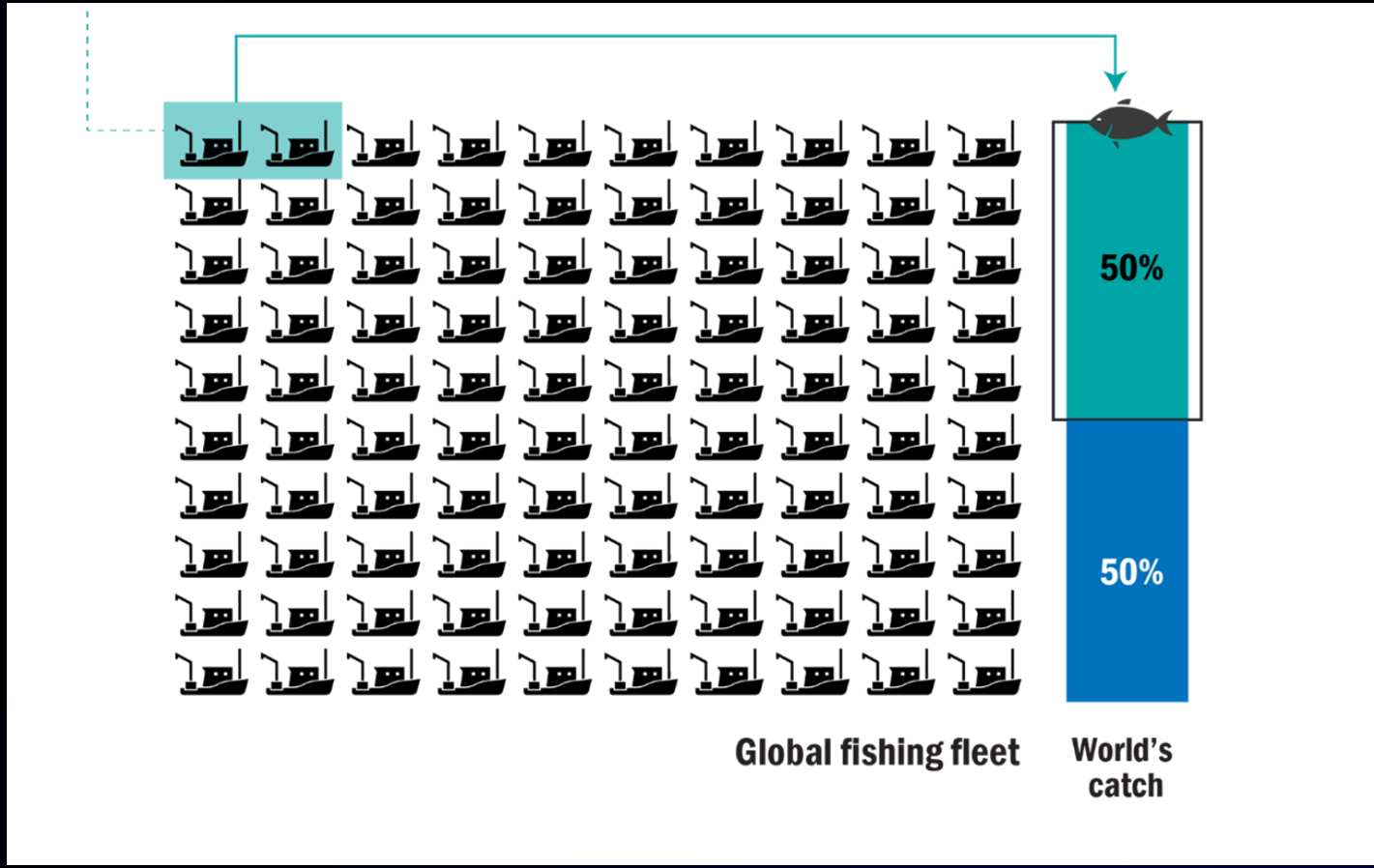


Stylized schematic of a trawl vessel outfitted with an EM system

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Winning in large-scale fisheries promises outsized impact

Just two percent of the global fishing fleet is responsible for 50% of the global catch



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Electronic monitoring has proven itself as a tool to illuminate the dark spots in fisheries

Our EM footage to date – this is from boats that **know** they are being watched – shows us that this technology can help us identify problems

- Illegal handling, retention, and release of other bycatch species (e.g., turtles, seabirds, sharks, rays)
- Cloths being used by crew members to cover cameras
- Target and bycatch volumes underreported in logbooks

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If we can solve pain points, EM data can also create value for a wide range of stakeholders

EM will be here to stay when its data goes beyond risk mitigation to also creating positive value for industry

Data on **where** and **when** the fish was caught, **by whom**, under **what conditions**, and **how** the product was stored/moved/processed could drive

- Improved supply chain efficiency
- Better understanding of compliance risks
- Analytics for product quality issues
- And a range of other market insights

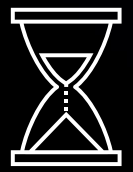
But we still need to address pain points for industry to effectively utilize this data and, ultimately, drive EM adoption

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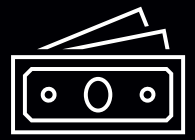
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For EM to realize its potential, we still have technical hurdles to overcome

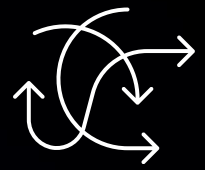
Today



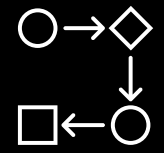
Time from data collection to review to action on the water is too long



Operational costs of using EM are too high



Logistics – which include moving and storing hard drives – are complex



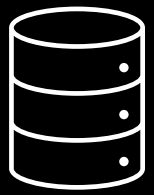
EM systems lack interoperability and adaptability

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AWS is helping to address EM's major pain points and drive change on the water



Employing AI/ML at review centers and on the edge



Building a standardized (but flexible) data architecture

Together, these two strategies pave the way for faster, more effective monitoring of conditions on vessels

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Employing AI/ML on the edge

How it works

On-vessel AI with EM systems independently inventories catch events and assesses compliance risk

AWS role

Developing AI and edge computing for compliance risk assessment

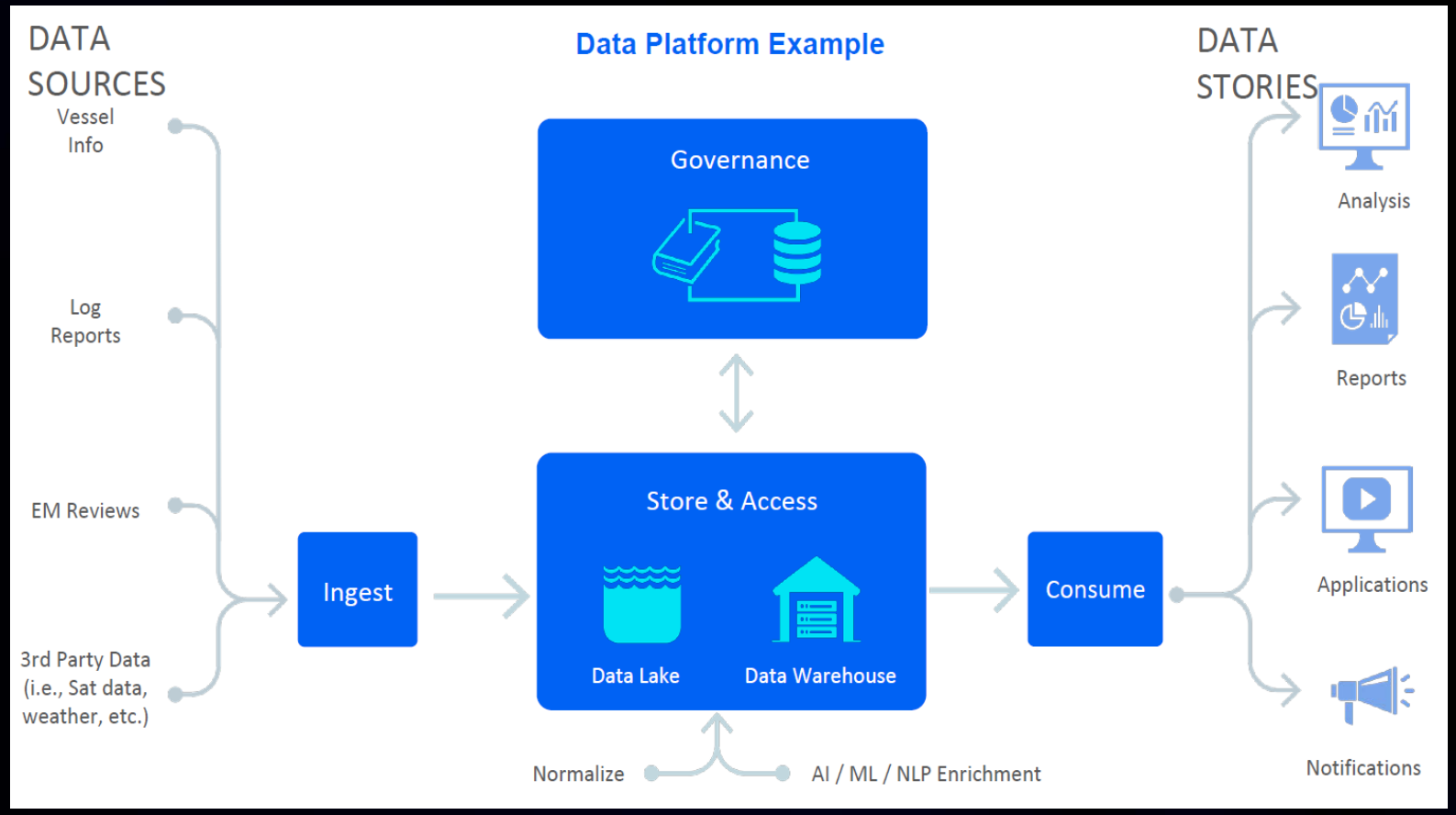


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Building a data architecture for EM

How it works

- Architecture, including a data model, that outlines governance, security, data warehouse, ingest, APIs, etc.
- Open-source stack that can be used by companies, RFMOs, etc.
- Platform as a Service (PaaS) that members could join to both add and retrieve data



AWS role: Providing expertise on architecture and supporting development of an open-source platform

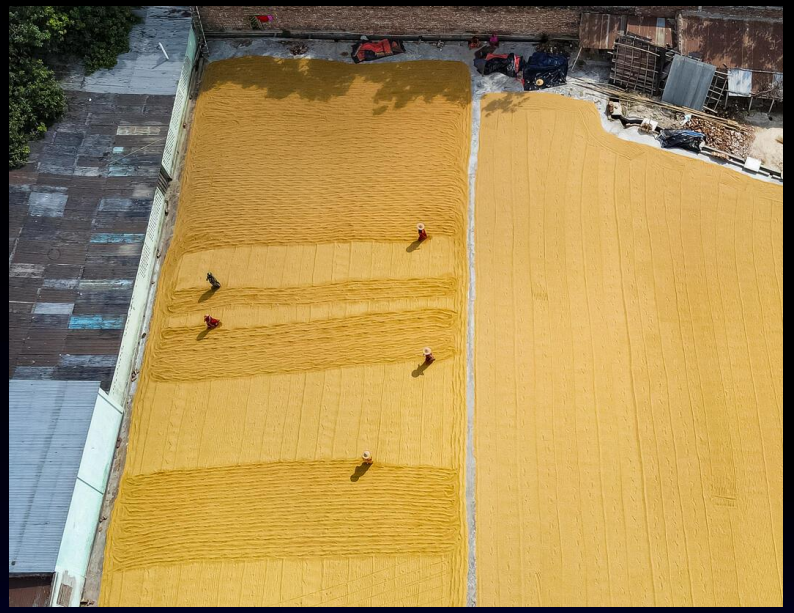
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This work has broader applications for the future of supply chains and conservation

Many other commodities are in dire need of a more sustainable, transparent status quo, but we know that **data alone doesn't solve problems**







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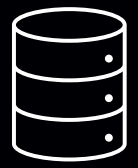
Edge computing and data platforms can address “first mile” transparency issues in other opaque and intermediated commodity supply chains

How these innovations can scale to other contexts



Edge computing for “first mile” data

Enable risk-based assessment of illegal and unreported activity and provide fast, scalable monitoring in a variety of agricultural settings



Flexible data platforms developed for EM

Enable us to structure other conservation and supply chain data, ensuring that we can maximize the data’s usefulness for other members of the conservation community and effectively inform scientific management

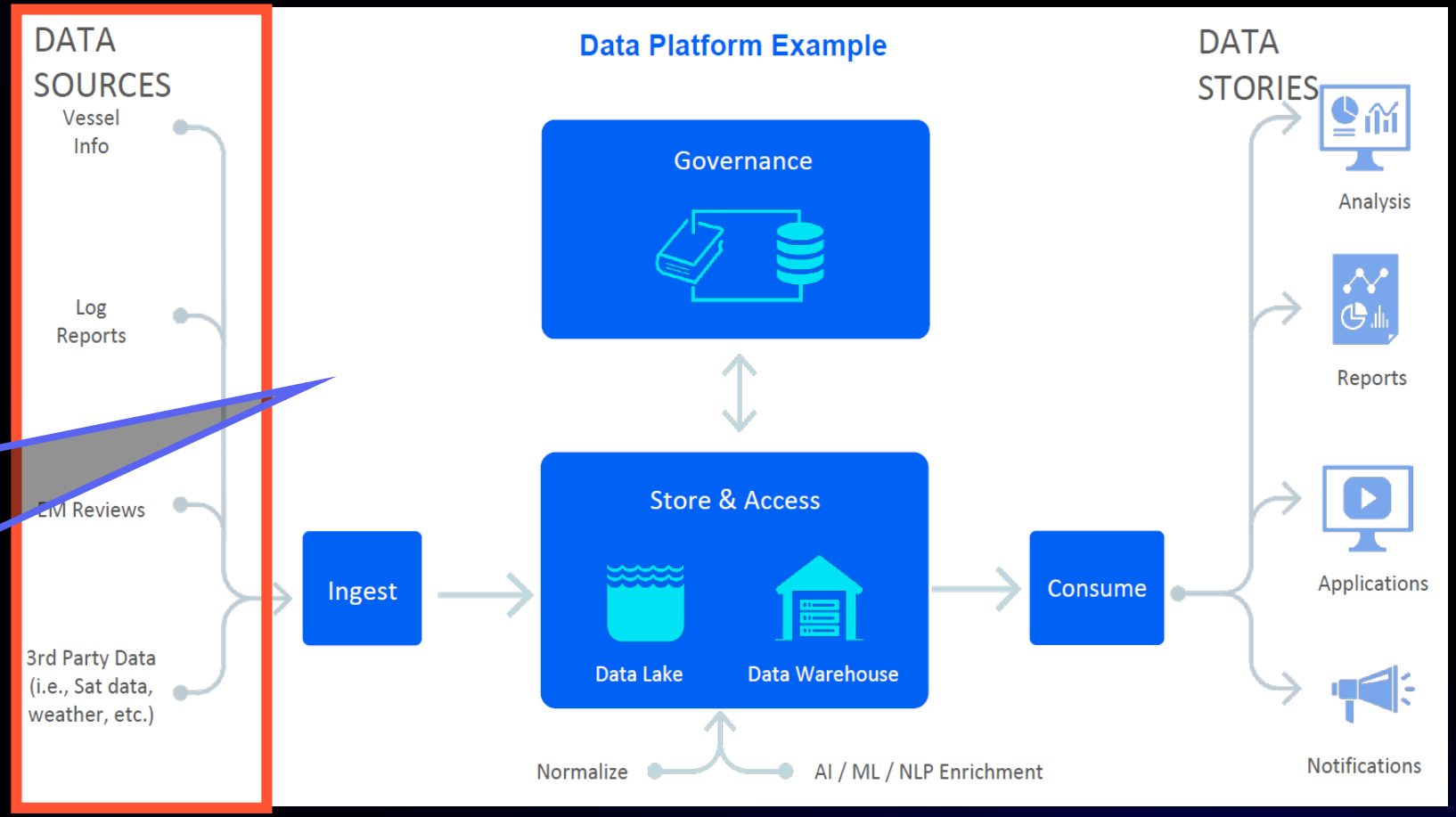
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Once we have a platform for this kind of data, we unlock opportunity across a range of issues

We're looking at on-the-water activity, but this could be substituted with timber harvest practices one day, or cattle grazing data the next

Enabling other organizations to ingest data from multiple sources, store it, and drive action is critical for building more resilient, sustainable supply chains



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We are scratching the surface of what data can do for conservation

The next decade will be won by investing in upstream in long-term, place-based strategies to improve supply chain sustainability

Adaptive management of the first mile of our supply chains will require more than just the ability to collect data

We will need to nimbly translate data points into actionable information that can drive adaptive management



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Thank you!

Nelson González
nrg@amazon.com

Mark Zimring
mzimring@TNC.org

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