Workout Report

Bridgestone + GE

Compiled by David Bingham
GE Digital Emerging Verticals
Version 2 – January 10, 2016

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Introduction

After progressing the relationship through 2016, members from Bridgestone and GE met at Bridgestone's corporate training center in Tokyo, Japan. For 3 days in mid-December, solution architect, sales, user experience, and engagement members from GE Digital worked alongside experts from Bridgestone's corporate and mining tire & conveyor groups to focus on desired outcomes and the operational specifics addressable within the industrial internet. The team derived 3 specific use cases around inspection, scheduling & logistics, and demand planning then dove into the details of the company's current operational state. The ecosystem map and presentation of each use-case provided a baseline to consider the future state and how best to leverage the Predix platform.

This document is a report on the materials and findings generated during this workout. It should be consumed alongside the separate use-case presentation videos and the formal commercial proposal.

Attendees

BRIDGESTONE JAPAN

Takashi Tomomoto
VP & SENIOR OFFICER, GLOBAL CMO

Tsuyoshi Kamiya
GM MINING TECHNICAL SERVICE

Nozomu Itoi
GM GLOBAL SOLUTION STRATEGY

Takeshi Yamamoto
ASSISTANT MANAGER

Takanao Shoji
MANAGER STRATEGY PLANNING

Shiho Hiraga
GLOBAL FLEET SOLUTION STRATEGY

Yuuki Hara
GLOBAL SOLUTION STRATEGY

BRIDGESTONE AUSTRALIA

Paul Comninos
SENIOR MANAGER

Beh Kim Wah
ENGINEERING MANAGER

GE

Tetsuya Nakamura
KEY ACCOUNT DIRECTOR

Mayoran Rajendra
PRE-SALES SOLUTION ARCHITECT

David Bingham
DIRECTOR UX DESIGN

Brian Sparling
DIRECTOR PRODUCT MANAGEMENT

Pierce Power
SALES MANAGER

Jose Marques
SOLUTION ARCHITECT

Natsumi Hoshi
SR TECHNICAL PROJECT MANAGER

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Agenda

Monday, December 12

ENTERPRISE & BUSINESS DOMAIN REVIEW

09:00 - 09:30	Introductions
09:30 - 10:00	GE Digital Transformation
10:00 - 11:00	Bridgestone Enterprise Overview
11:15 - 12:00	Enterprise Prioritization
12:00 - 01:00	Lunch
01:00 - 03:30	Mining Tire Overview
03:45 - 04:45	Mining Tire Pain Quantification
04:45 - 05:30	Ecosystem Mapping Overview

Tuesday, December 13

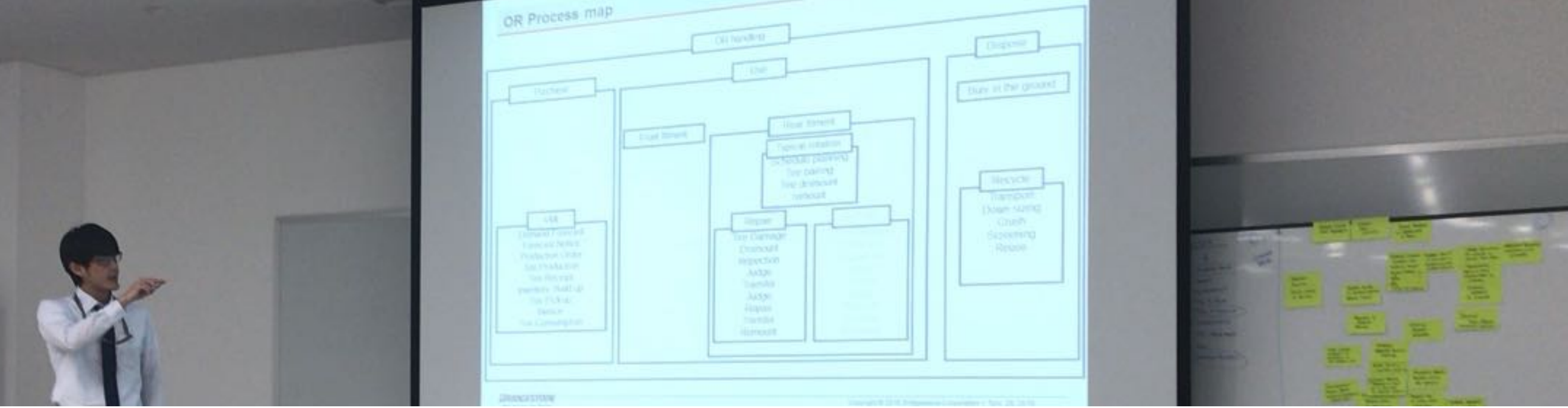
MINING TIRES DEEP DIVE

08:30 - 08:45	Recap
08:45 - 10:00	Ecosystem Mapping Breakout
10:00 - 10:45	Regroup & Report
11:00 - 12:00	Predix Overview
12:00 - 1:00	Lunch
01:00 - 02:00	Future day in the life
02:00 - 02:45	Regroup & Report
03:00 - 03:45	Solution Review
03:45 - 05:30	Conveyor Overview

Wednesday, December 14

CONVEYOR BELT DEEP DIVE & WRAP

08:30 - 08:45	Recap
08:45 - 9:30	Conveyor Pain Quantification
9:30 - 10:30	Ecosystem Mapping Breakout
10:30 - 11:15	Regroup & Report
11:30 - 12:30	Future day in the life
12:30 - 1:30	Lunch
1:30 - 2:15	Regroup & Report
2:15 - 2:45	Solution Review
3:00 - 4:00	Exec Report Prep
4:00 - 5:30	Report Out & Next Steps



Process

GE Digital and Bridgestone worked in a highly collaborative and generative process leveraging our cross-disciplinary teams. The workshop flow moved from big-picture to specific focused areas while shifting from current to future state. While the team remained flexible in agenda adjustments, the overall process is:

1. Profile enterprise-level goals.
2. Derive mining tires and conveyor business outcomes & use-cases.
3. Map the use-cases' current operation ecosystem.
4. Outline the future-state opportunities and methods to approach.

Enterprise Overview

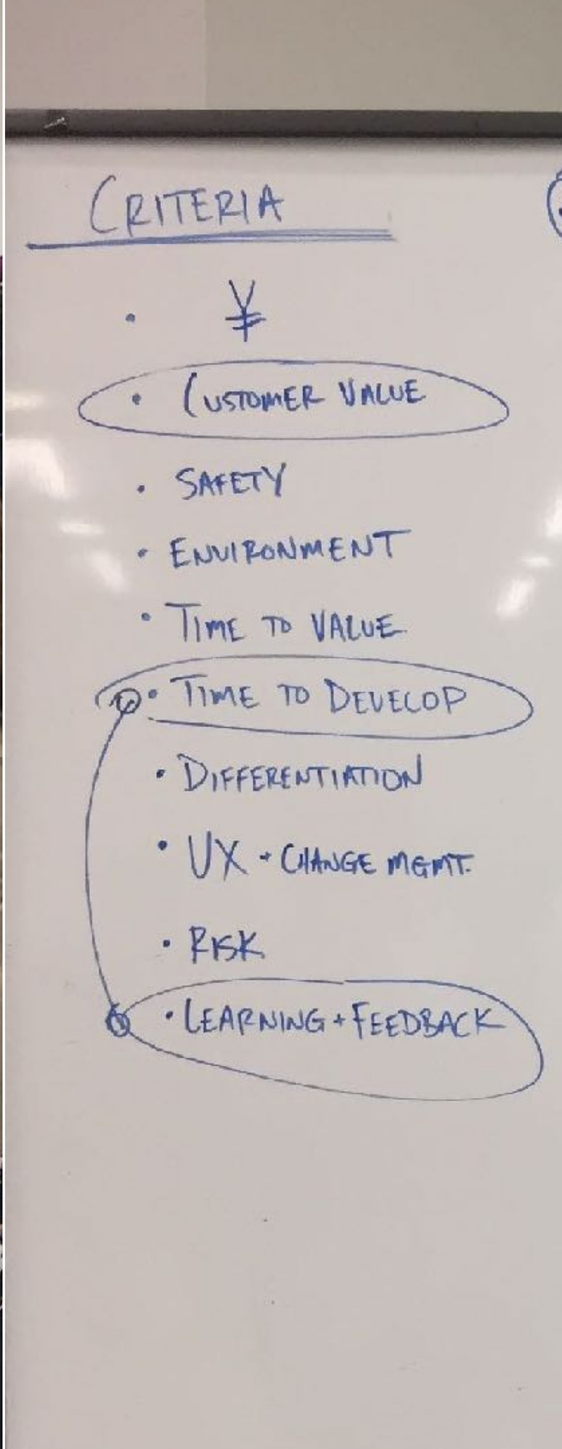
We start with orienting our goals around high-level business objectives. Combining information provided ahead of the workout with Tomomoto-san's overview, the team collected a number of enterprise goals on yellow notes. Once collected, we discussed which criteria are important to Bridgestone in decision-making. The top selections (from the overall list to the right) were:

1. Customer Value *(not just Bridgestone value)*

2. Quick Development & Learning

These criteria drove not only the organization of enterprise goals, but were intentionally re-used in sorting mining tire and conveyor business goals. Using the same relational axes allowed cross-comparison between corporate and the business goals, which the team continuously referenced to maintain alignment.





Enterprise Overview

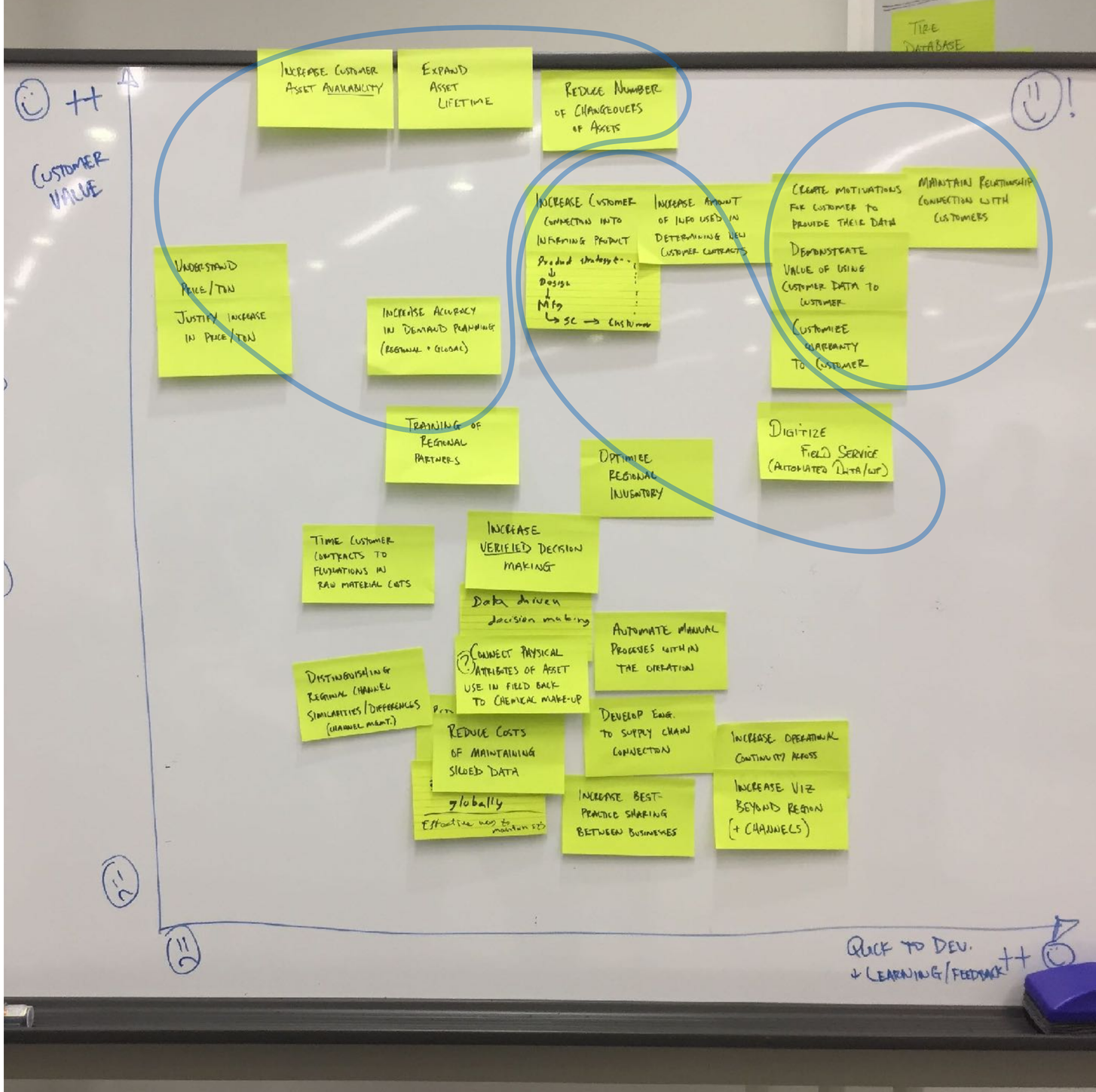
Generally grouping the higher-ranked goals, we see a picture of Bridgestone's enterprise evolution:

Gather Data
Maintain relationship connection with customers.
Create motivations for customer to provide data.
Demonstrate value of using customer data.

Form Insights
Increase info used in customer contracts.
Increase customer connection to informing product.
Digitize field services.

Optimize Operations
Reduce number of asset changeovers
Expand asset lifetime
Increase customer asset availability

This order is common in digital transformation. The lower items may happen concurrently in support of the greater goals or readjust with new learnings.



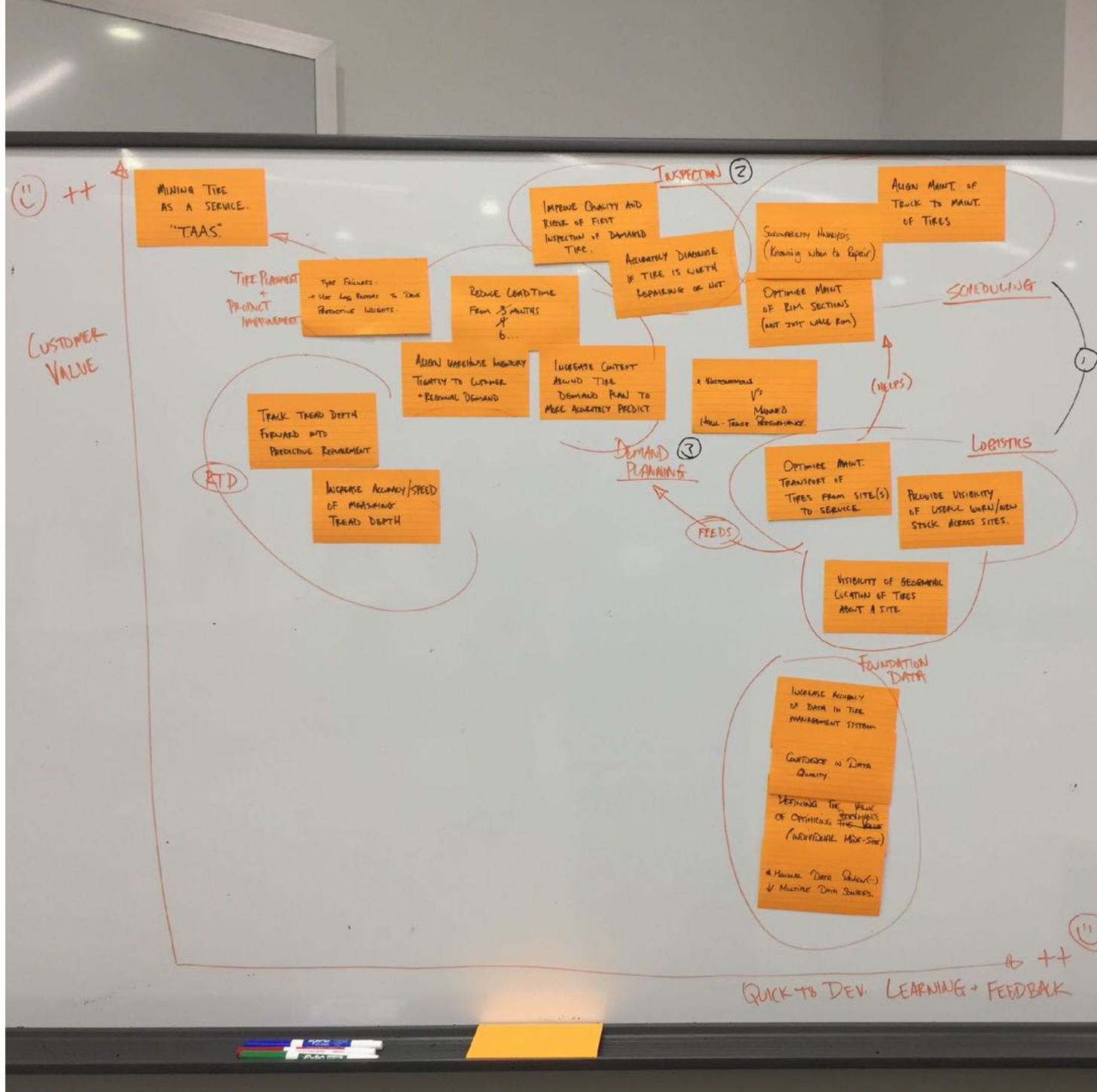
Mining Tires Priorities

Having received an extensive overview of the Mining Tires business, the team structured a map using the same relational axes. Groupings naturally emerged in the following categories:

Scheduling & Logistics
Align truck and tire maintenance.
Servicability analysis.
Provide visibility of useful stock across sites.
Optimize transport of tires from site to service.

Inspection
Improve quality and rigor of first inspection.
Accurately diagnose if tire is worth repairing.

Demand Planning
Increase tire demand plan accuracy.
Reduce overall lead time.
Align warehouse inventory to demand.



Conveyor Priorities

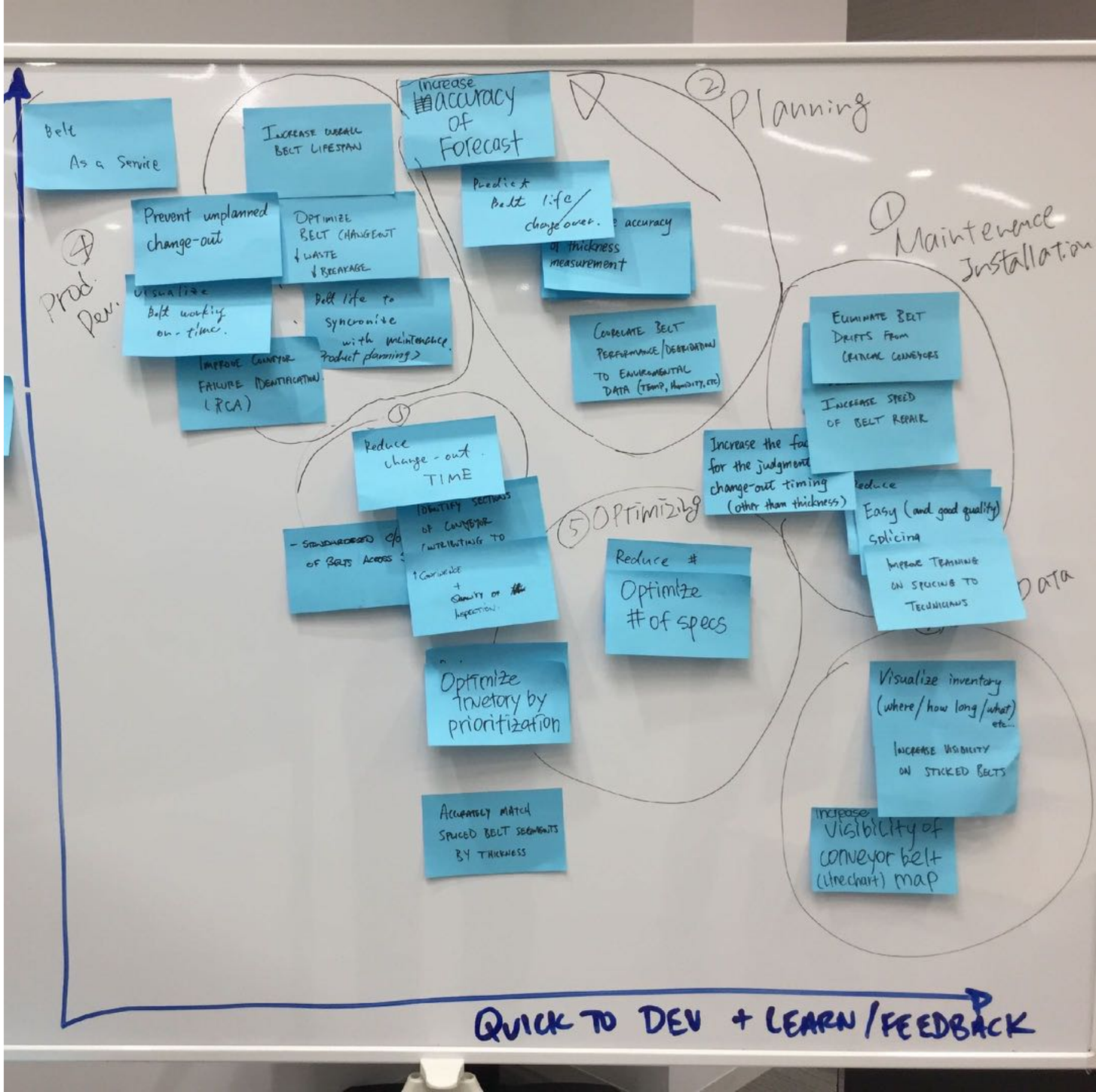
Similar to mining tires, the conveyor team presented their business details then organized goals along the same axes. A very similar set of groupings emerged:

Maintenance Installation
Eliminate belt drift from critical conveyors.
Increase speed of belt repair.
Increase judgement of change-out timing.

Demand Planning
Increase accuracy of forecast.
Predict life/changeover.
Correlate belt deterioration to environmental data.

Optimizing
Optimize number of belt specifications.

With categorical similarities to the tire business, the group decided to stay within their same breakout teams and shift focus to conveyors.



Breakout Teams



Breakout Teams

Business Use-Case Focus

The breakout teams spread about the room to develop ecosystem maps for each of their use-cases. An ecosystem map helps outline IoT situations by breaking down the users, their tools & things, and the environments in which they operate. Structuring the understanding of processes in this way allows breaking large & complex topics into smaller and more addressable issues.

The teams were comprised of an even mix of GE and Bridgestone members with expertise in both mining tires and conveyors. 1 hour was spent on the current state of mining tires, then each team presented to the group for 15 minutes including receiving feedback from the audience. Then the teams regrouped for the same amount of time to map the potential future state with another 15 minute presentation.

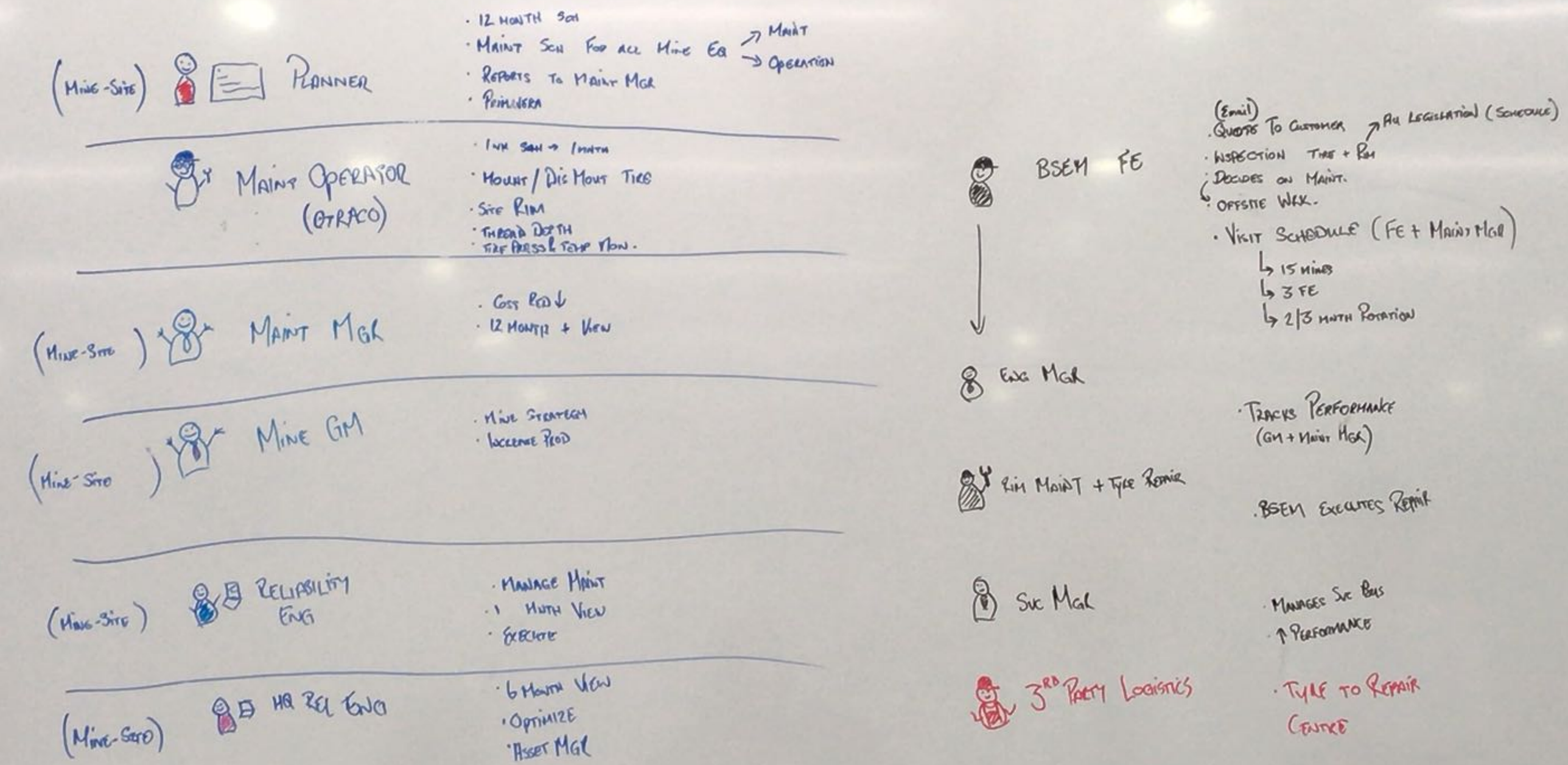
It is recommended to view the following images alongside the recorded video presentations from each group.



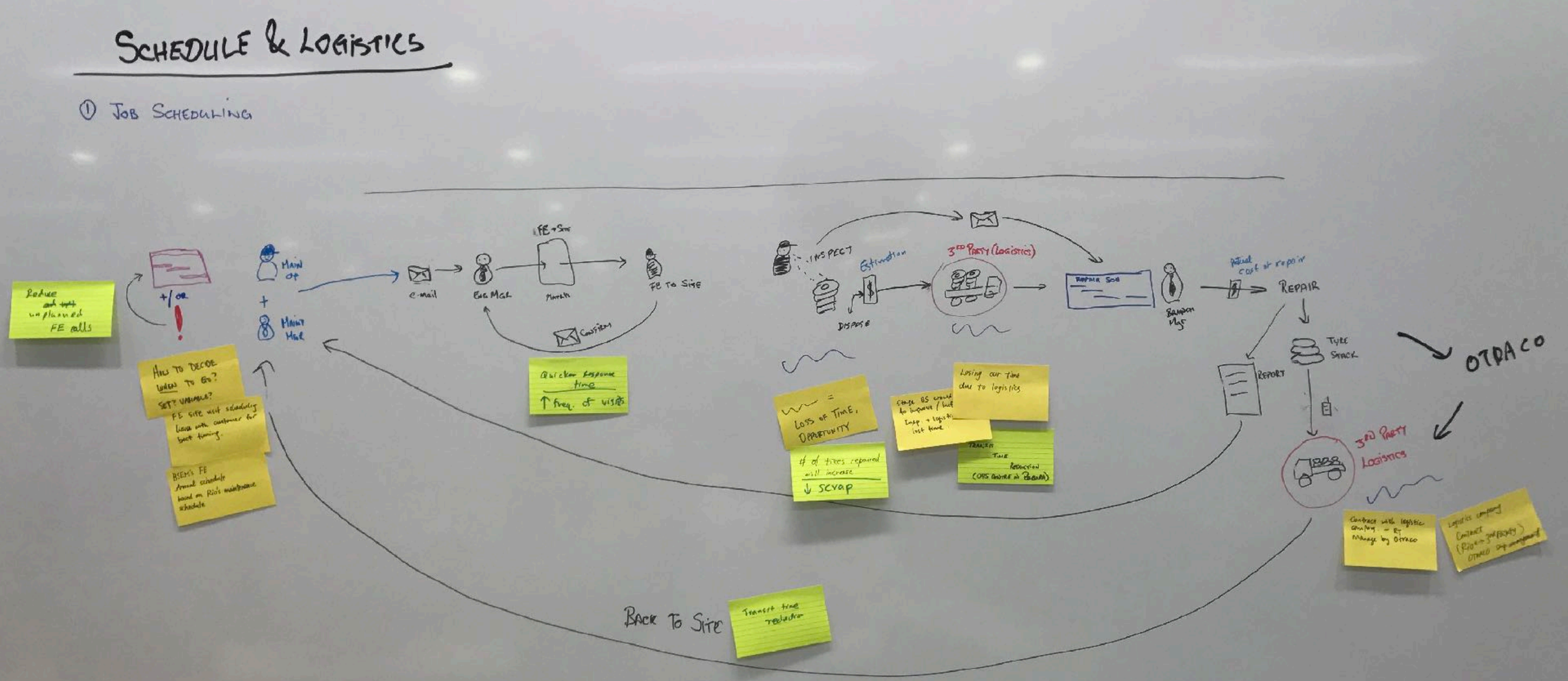
Breakout Team 1

Scheduling & Logistics

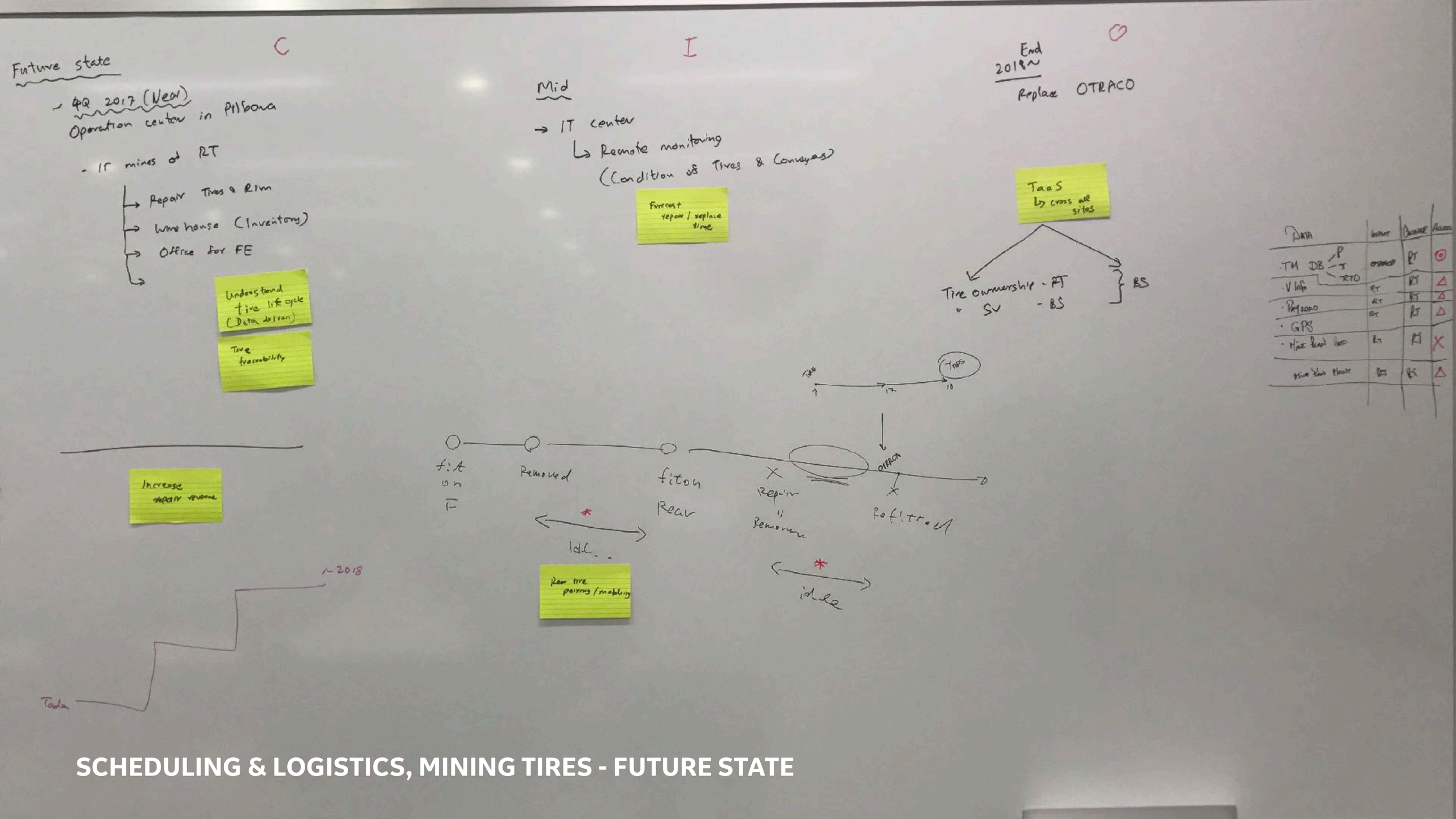




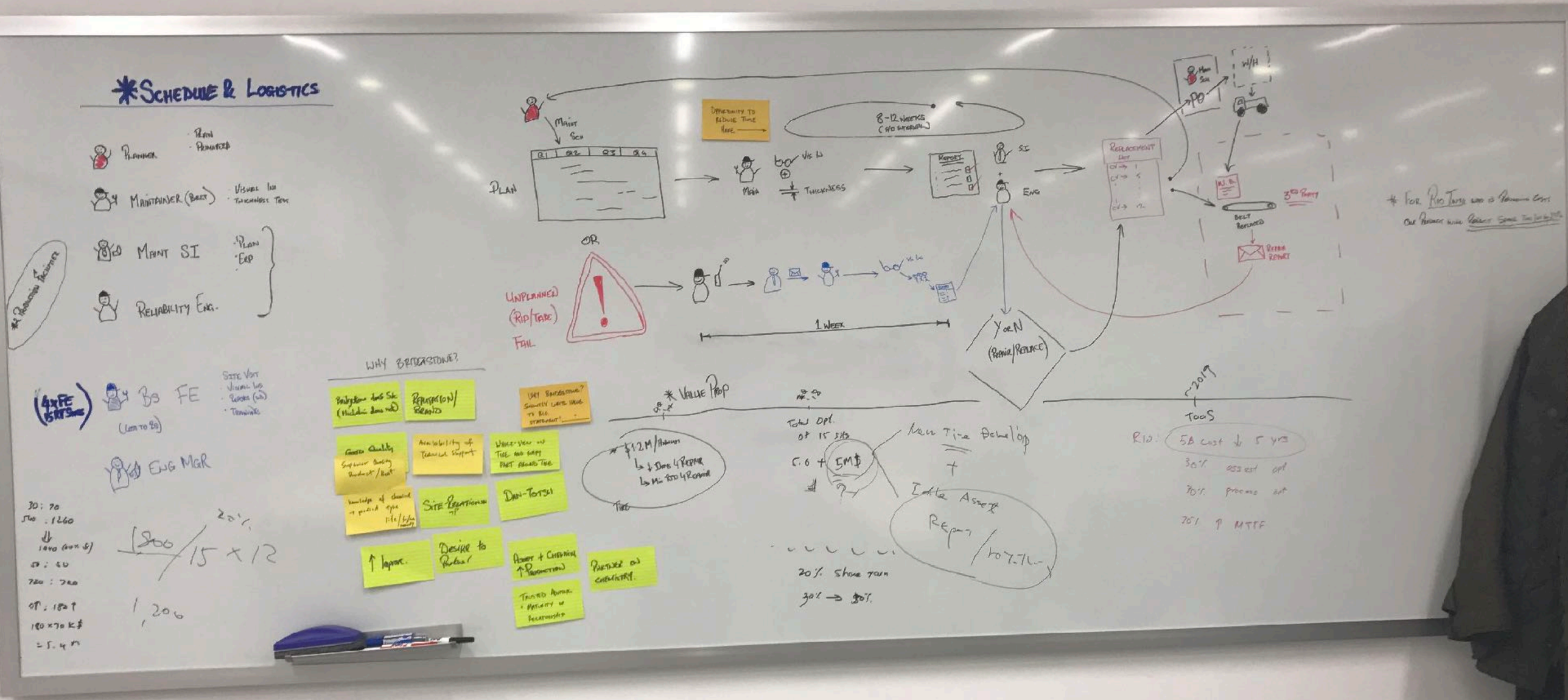
SCHEDULING & LOGISTICS, MINING TIRES - CURRENT STATE



SCHEDULING & LOGISTICS, MINING TIRES - CURRENT STATE



SCHEDULING & LOGISTICS, MINING TIRES - FUTURE STATE



SCHEDULING & LOGISTICS, CONVEYOR BELTS

Breakout Team 2

Inspection



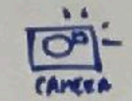
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INSPECTION

USERS

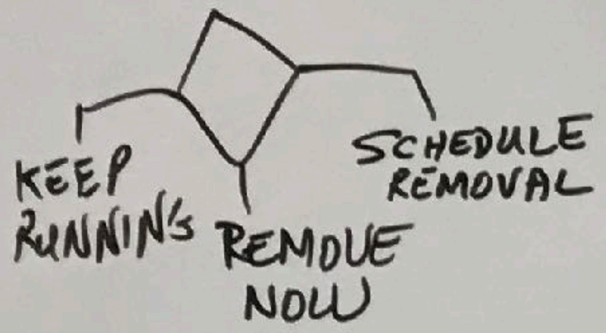
FIELD ENG - BRIDGESTONE

ON-SITE TIRE INSPECTION (OUT OF SVC)
YES/NO - REPAIRABLE / CLAIM / SCRAP / RTS
EVERY 2 MONTHS



OTRACO - TIRE SVC FIELD SVC

IN-SVC INSPECTION [ON-SITE]
DECIDE DAMAGE ASSESSMENT



REPAIR CENTER

REPAIRER - BRIDGESTONE

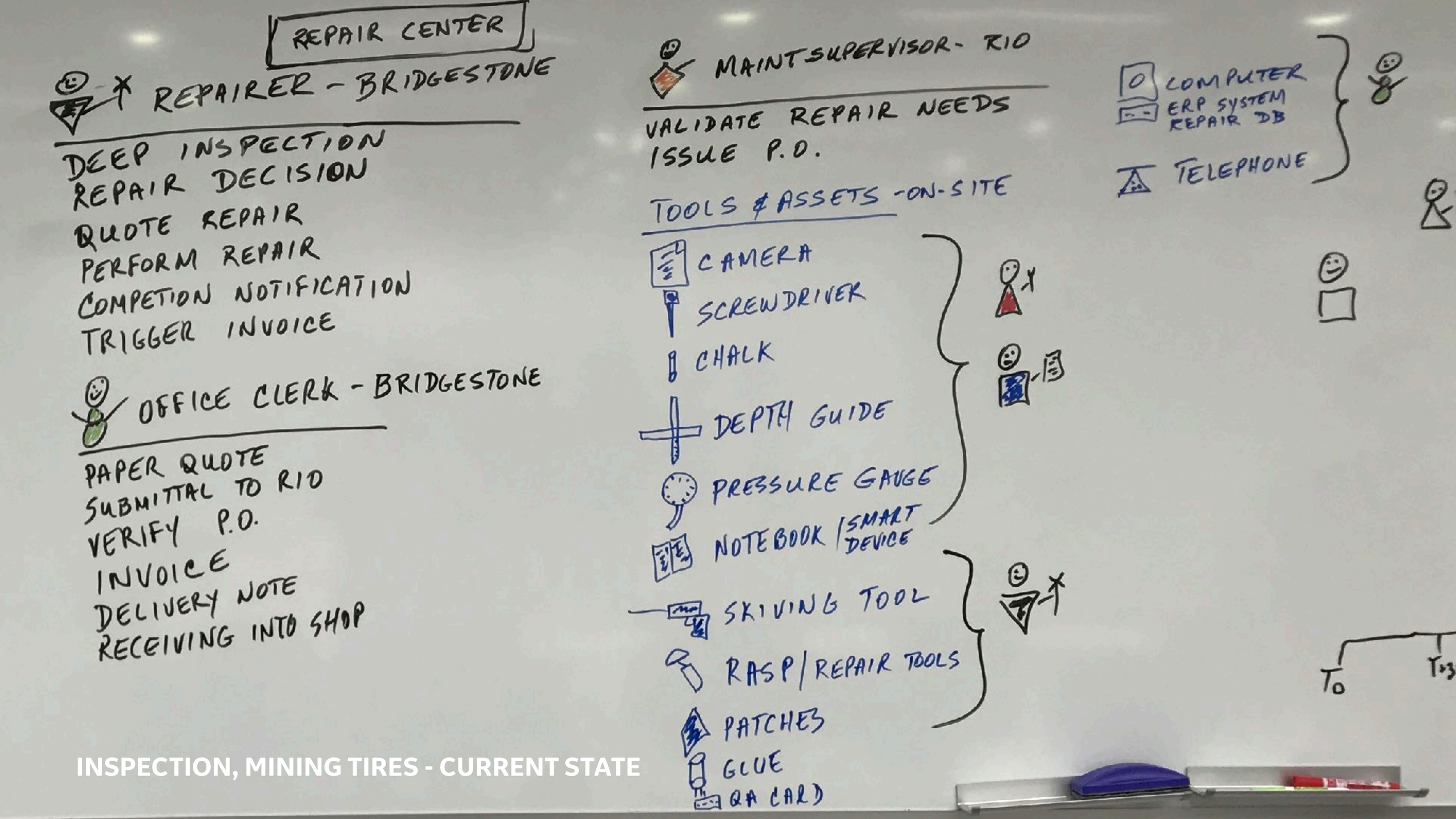
DEEP INSPECTION
REPAIR DECISION
QUOTE REPAIR
PERFORM REPAIR
COMPETION NOTIFICATION
TRIGGER INVOICE

OFFICE CLERK - BRIDGESTONE

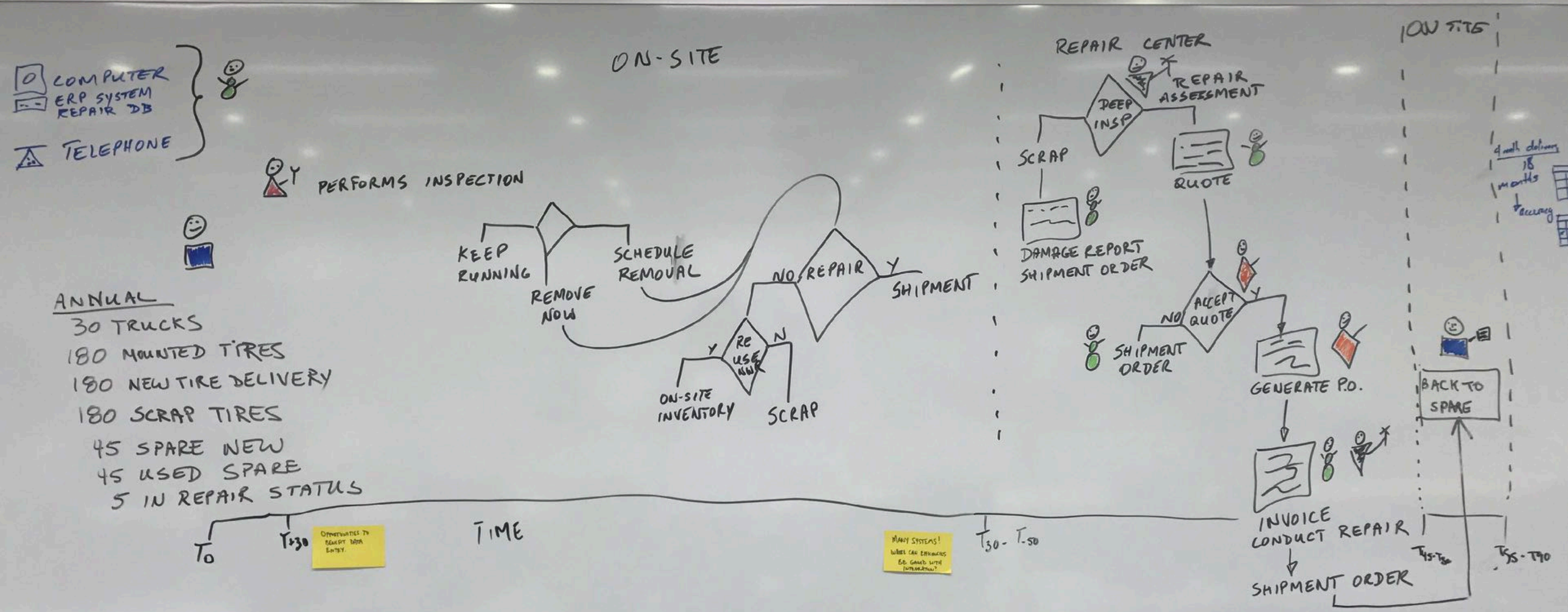
PAPER QUOTE
SUBMITTAL TO RID
VERIFY P.O.
INVOICE
DELIVERY NOTE
RECEIVING INTO SHOP

VAL
ISS
TOO

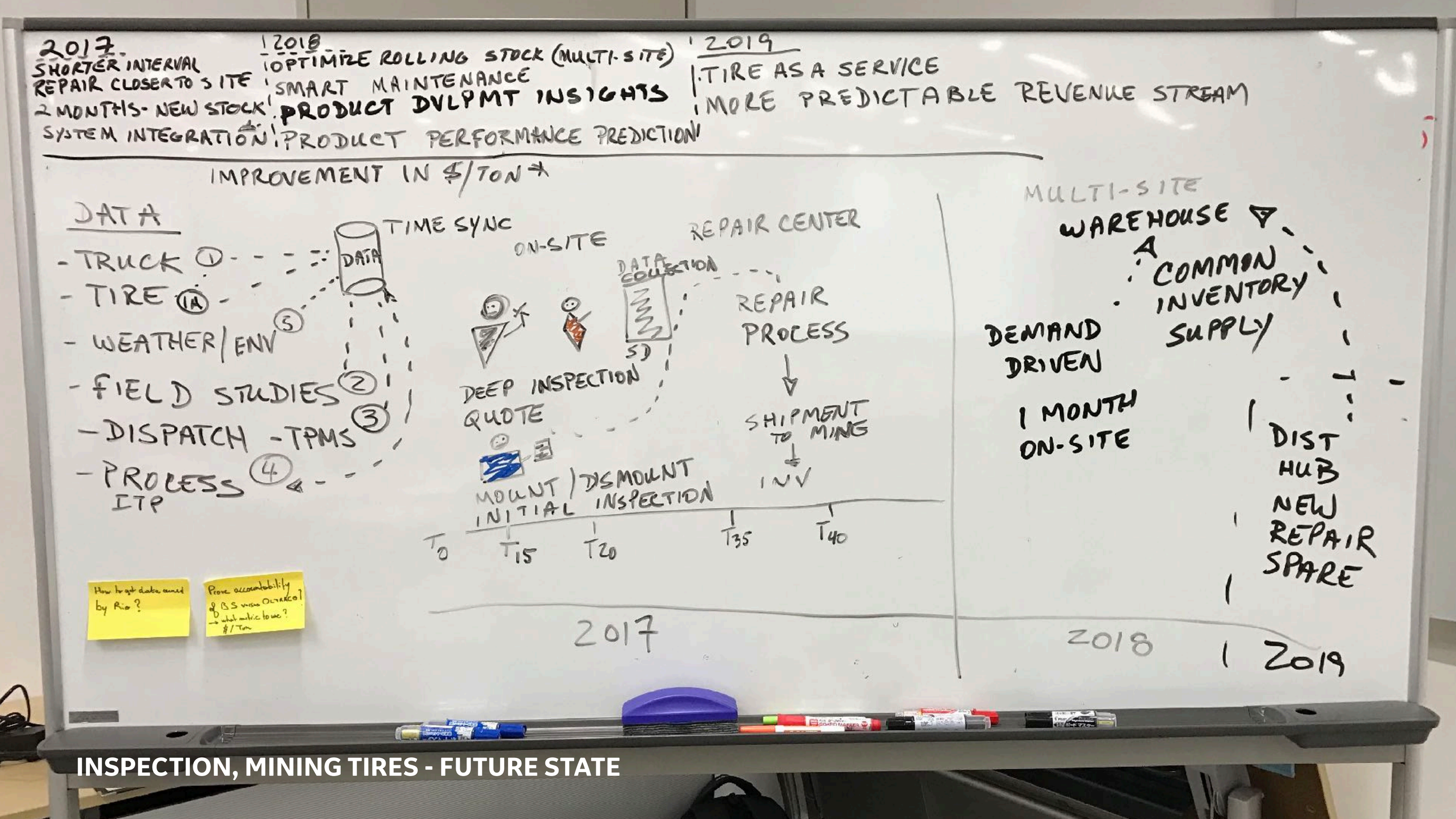
INSPECTION, MINING TIRES - CURRENT STATE



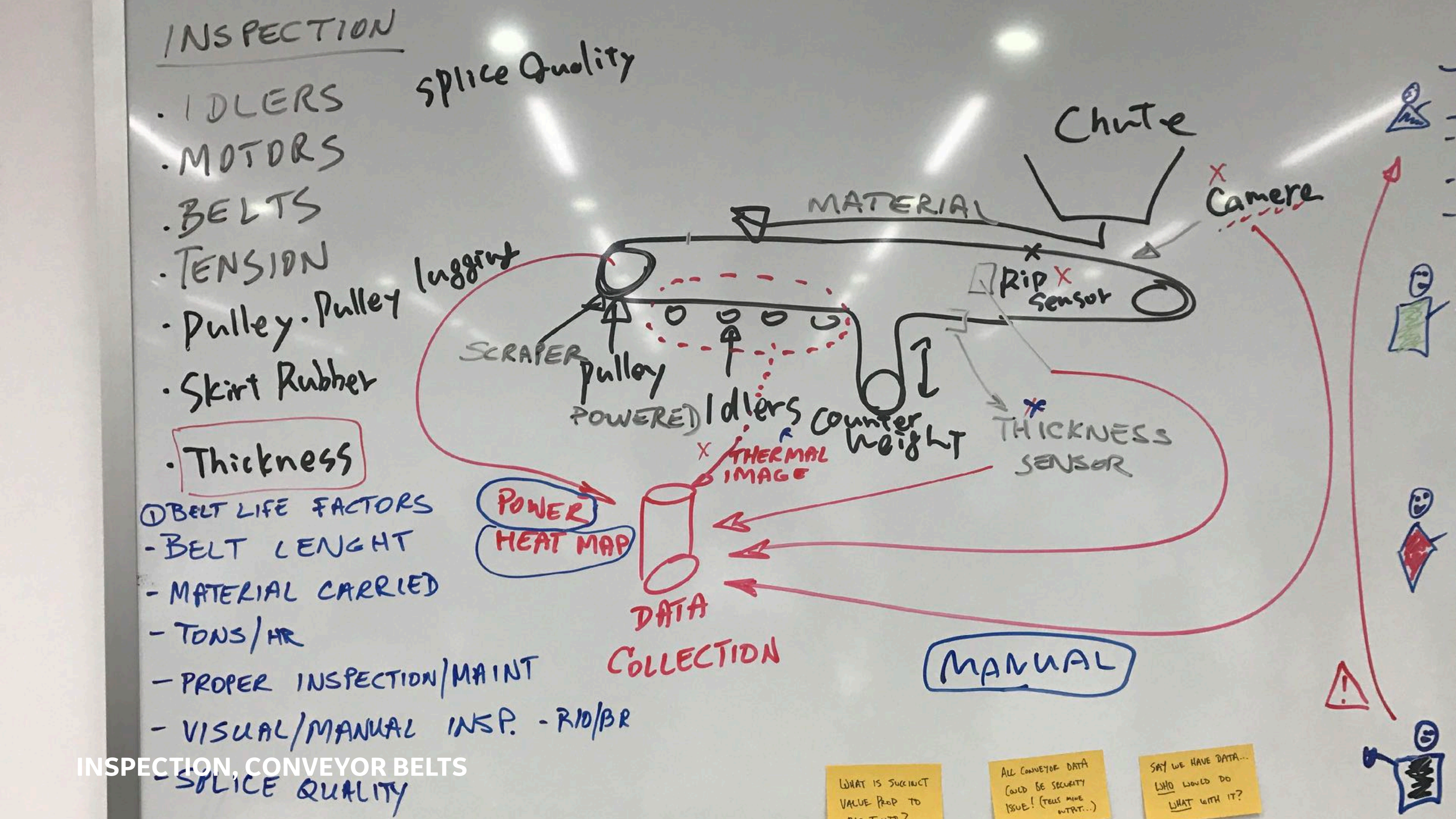
INSPECTION, MINING TIRES - CURRENT STATE



INSPECTION, MINING TIRES - CURRENT STATE



INSPECTION, MINING TIRES - FUTURE STATE



INSPECTION, CONVEYOR BELTS

USERS



RIO INSPECTOR - MAINT

- IDENTIFY POSSIBLE FAILURE
- DETERMINE MAINT NEED
- REPORTS STATUS (thickness)



BRIDGESTONE FIELD ENG.

- Consulting
- splice QA



3rd PARTY SPLICER

- installation





RIO OPERATOR

- CONTACT MAINT IF ISSUE

Digital Landsc (Mire

SYSTE CV

- SYST
- PARTS
- USE
- LOC
- ENV

USAGE

ANALYTI

- MATER
- PHYSI
- USAG

INT

E FAILURE NEED

D ENG.

Digital Landscape (Mire-kwl)

SYSTEM DEF CV

- SYSTEM ID
- PARTS INV
- USE
- LOCATION
- ENV CONDITION

ICER

ISSUE

USAGE DATA/PART

ANALYTIC

- MATERIAL SCIENCE
- PHYSICS
- USAGE PATTERNS
- PRODUCT LIFECYCLE
- VALUE $/tons

DATA

- BELT ID CHARACTERISTICS
  - WIDTH
  - TENSILE STRENGHT
  - THICKNESS
  - RUBBER GRADE
  - CONSTRUCTION
  - LOCATION
  - INV STATUS

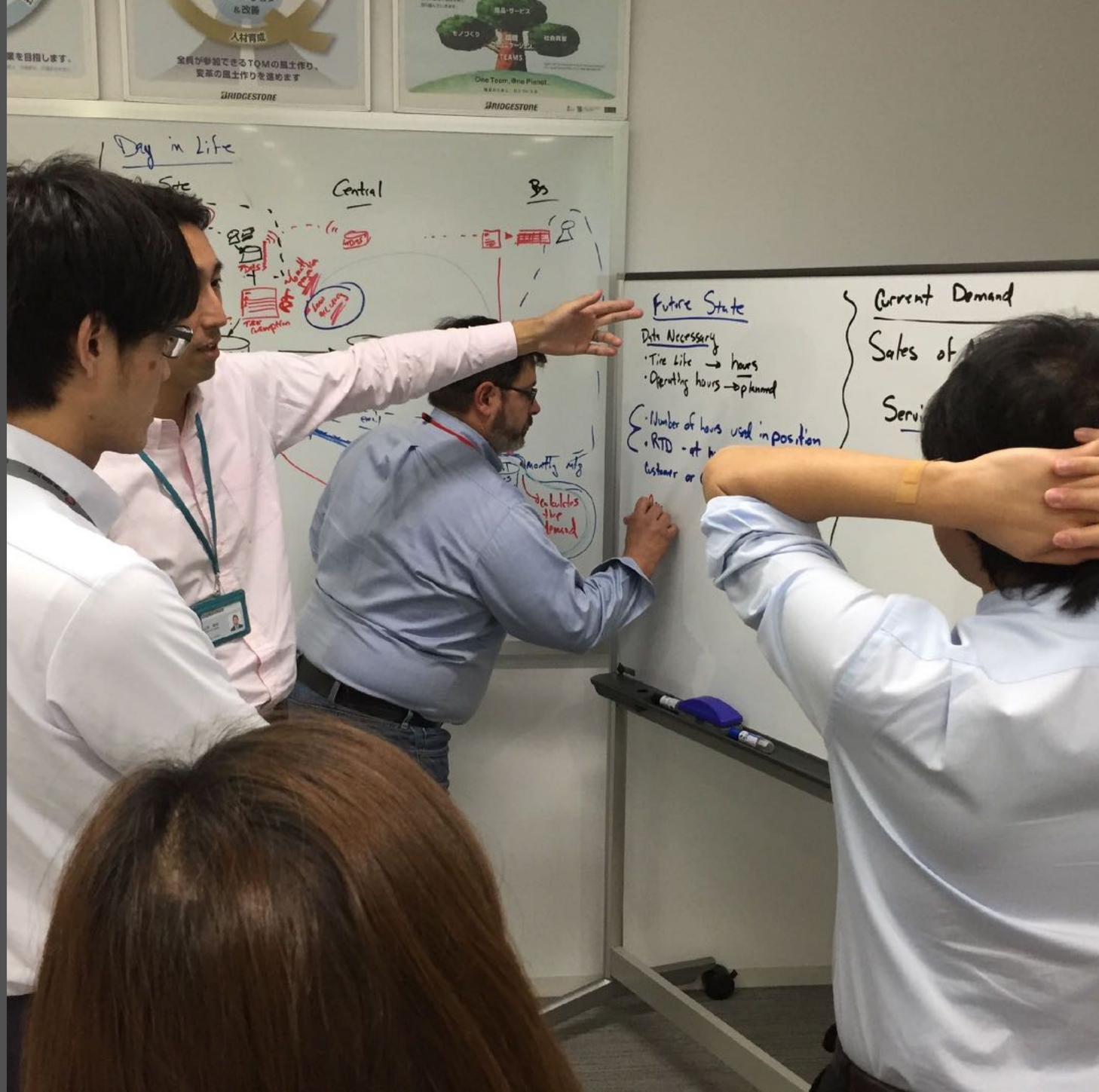
BELT DATA PTS

- TENSION
- THICKNESS
- RIP SENSOR (Y/N)
- SPEED
- POWER CONSUMPTION
- TONS/hr.
- IMAGE PROCESSING

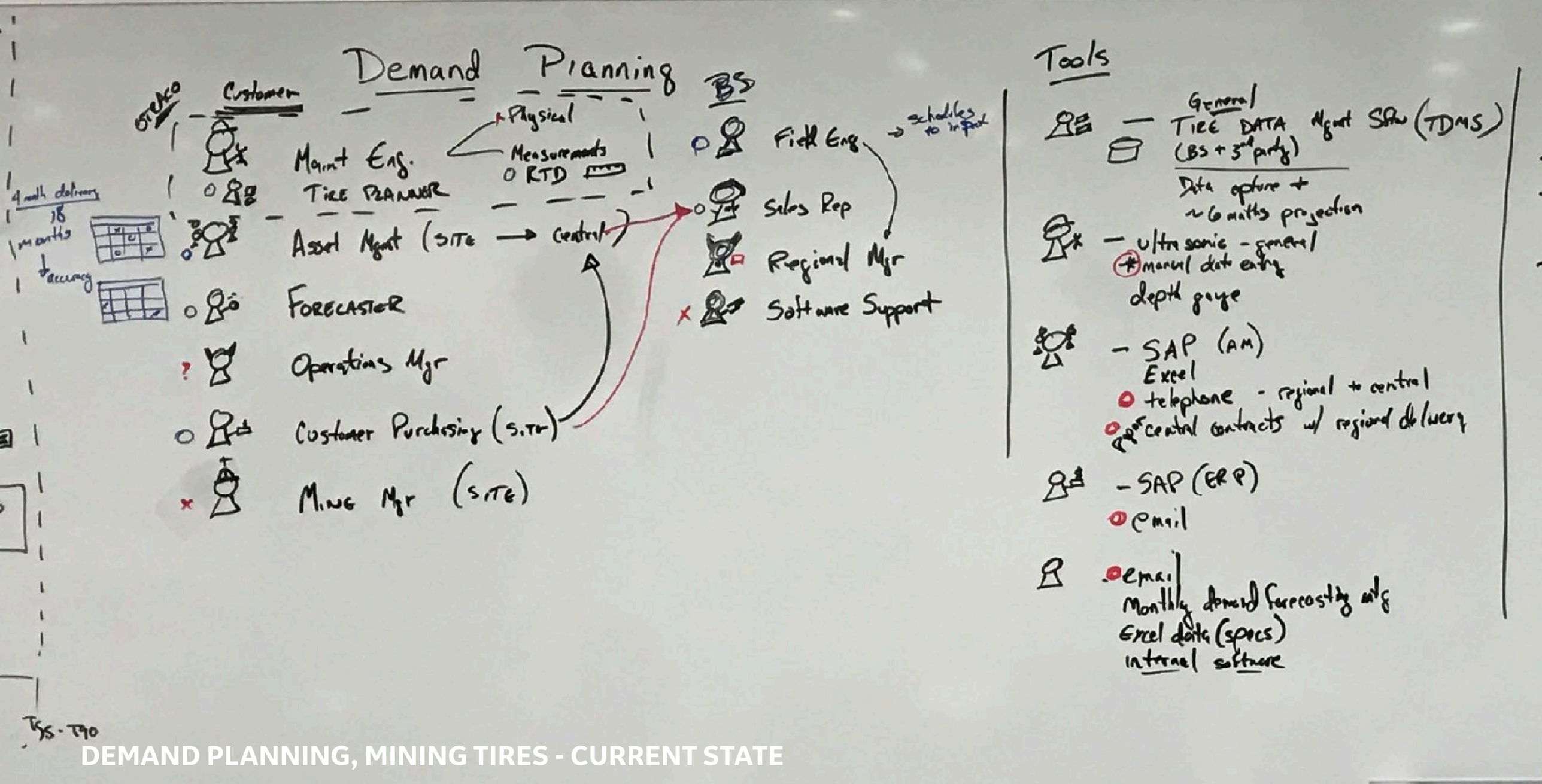
INSPECTION, CONVEYOR BELTS

Breakout Team 3

Demand Planning



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DEMAND PLANNING, MINING TIRES - CURRENT STATE

BRIDGESTONE

General
TIRE DATA Mgmt Sftw (TDMS)
(BS + 3rd party)

Data capture +
~6 months projection

- ultrasonic - general
- manual data entry
- depth gauge

- SAP (AM)
- Excel
- telephone - regional + central
- central contracts w/ regional delivery

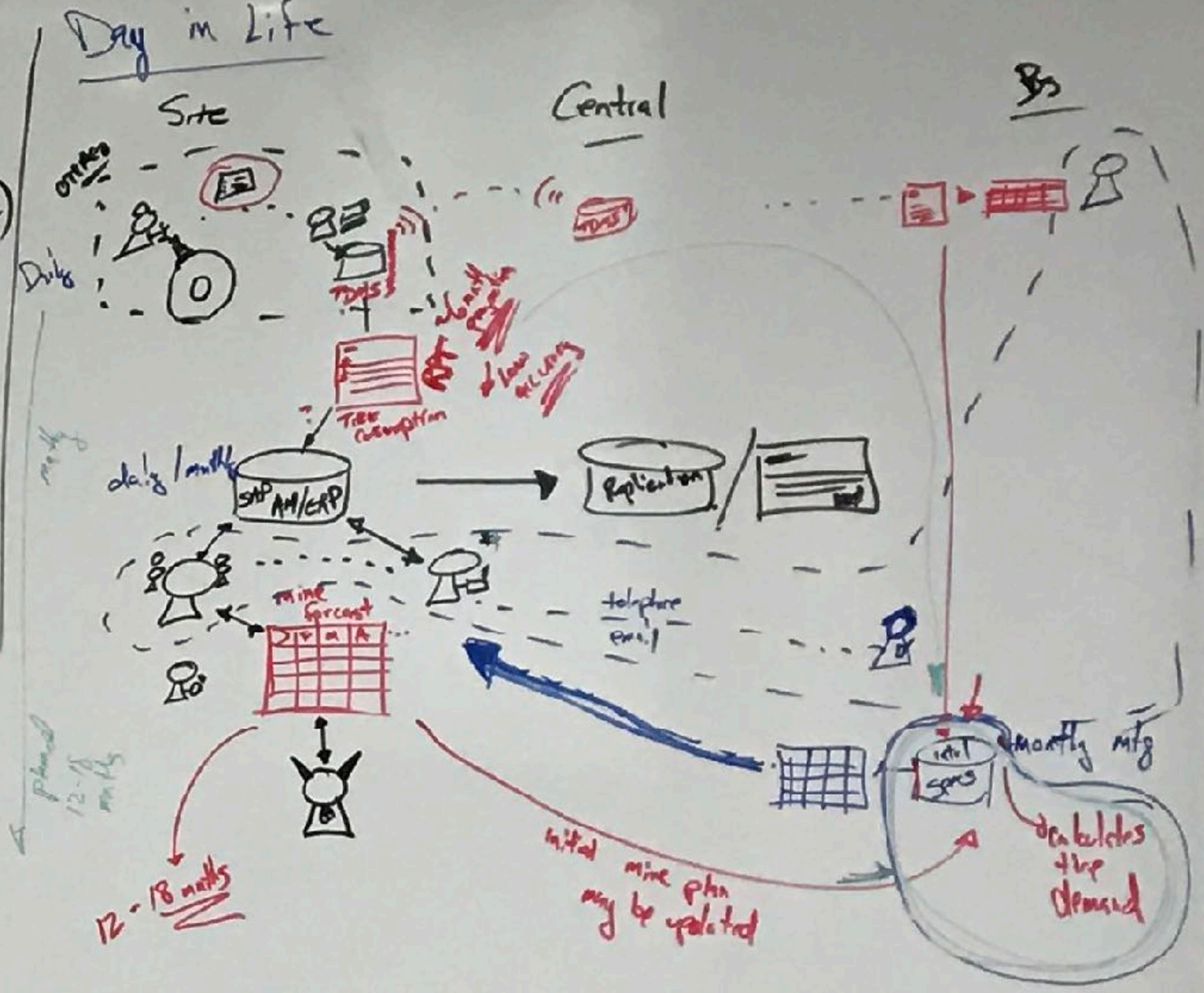
- SAP (ERP)
- email

- email
- monthly demand forecasting mtg
- excel data (specs)
- internal software

Locations

- MINE SITE → office
- customer Central office (ex: Singapore)
- BS Regional office
- mine site service shop
- BS HQ

Day in Life



DEMAND PLANNING, MINING TIRES - CURRENT STATE

Future State

Data Necessary

- Tire Life → hours
- Operating hours → planned

- Number of hours used in position
- RTD - at hours used

- Accumulated Use (Weather, Load, Speed)*
  - Actual Operating hours
  - Unanticipated failure

Current Demand Forecast

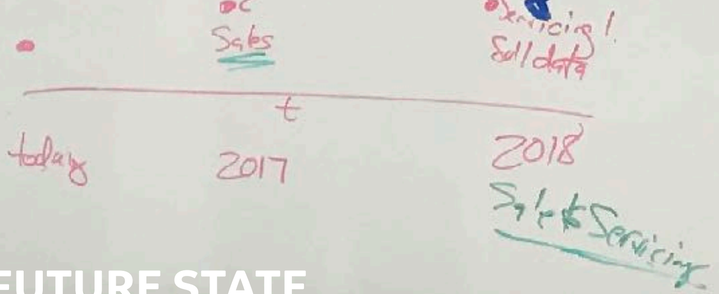
- Sales of New Tyres (Manuf) → full data analysis
  - ↳ linear algorithm using sampled data
- → Servicing Existing Tyres

PROBLEM:

Data accuracy & forecast are low because of Sampling

Potential Solutions:

1. Rewrite forecast algorithm to use all data
2. Find a cleaner way to sample



DEMAND PLANNING, MINING TIRES - FUTURE STATE

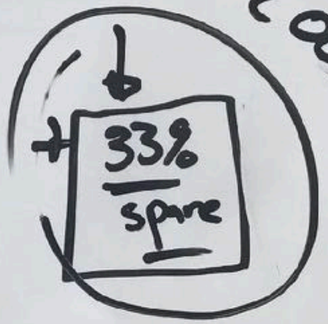
OTR

New Tire - $35.000

Serviceability - $12.000

Trucks / site = 30 x 6

Transport / tire = $500



Site x 30

200 days

Service

$525K/18 mo$ /site

2 → 1.5 /per truck

Tire life to scrap = 18 months fixed (ave)

Per Tire Ave Service = 3 x 500 ft = on-site - $9000 /truck

Rotate Position = 90 days

30 y / 18 mont.

Floor cost

= 180 x $35.000

45 + 60 x $35.000

240 x 35.000

Initial cost

$8.4 MM → $176 MM

Service Cost

18 months x 30 years

$5.4 MM

Onsite rotation

= $270.000 total

DEMAND PLANNING, MINING TIRES - FUTURE STATE

FOR RIO TINTO

WHO IS spending too much on spare tires

OUR DEMAND PLANNING PRODUCT

WILL REDUCE EXCESS PURCHASE OF NEW OTR TIRES BY ~$525.000 / 18 months / SITE without reducing truck availability

DEMAND PLANNING, MINING TIRES - FUTURE STATE

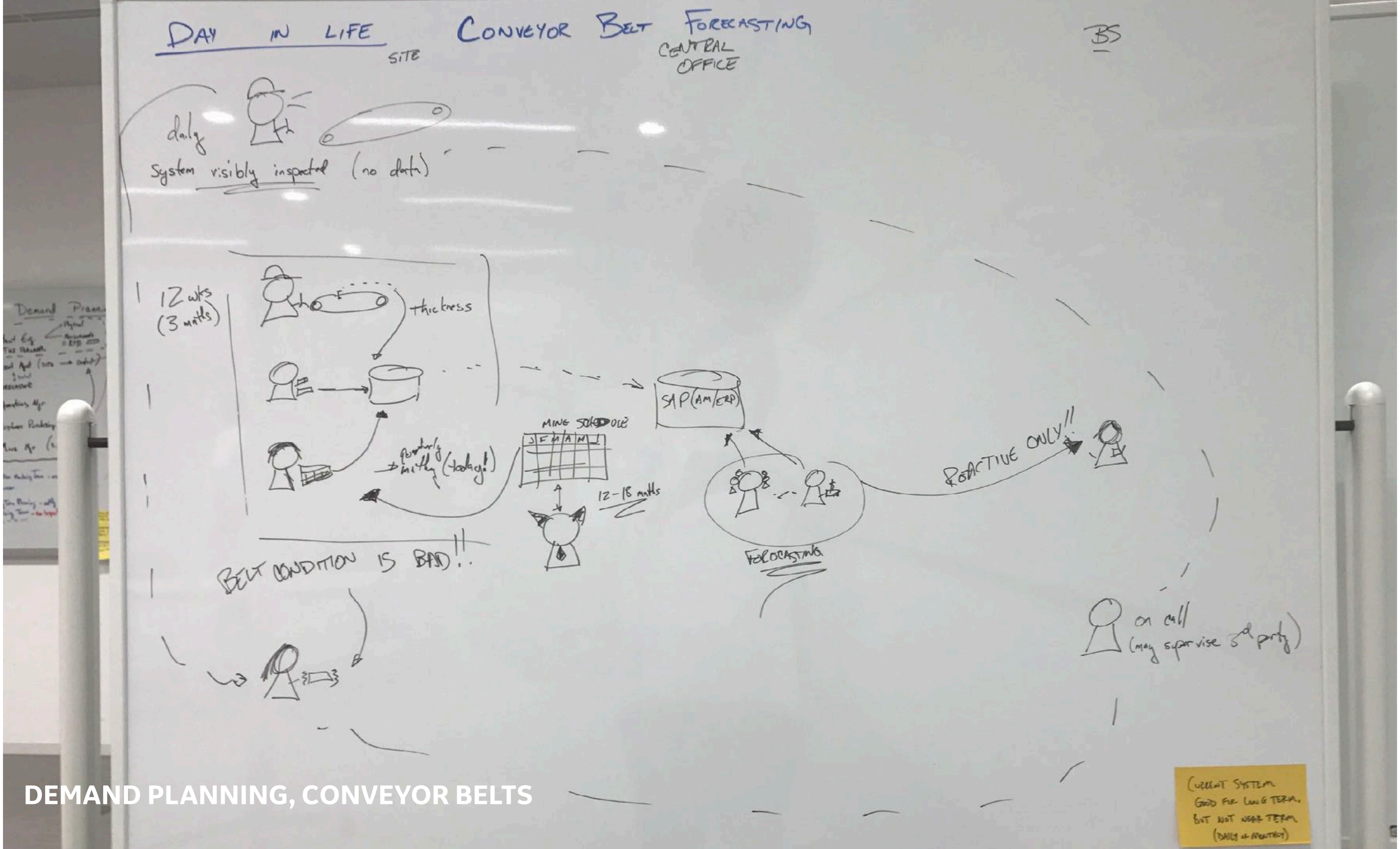
FOR BRIDGESTONE

WHO MANUFACTURES TIRES

OUR DEMAND PLANNING PRODUCT

WILL REDUCE THE NEED TO MANUFACTURE EXCESS INVENTORY AND ENABLE A FLEXIBLE MANUFACTURING SCHEDULE

DEMAND PLANNING, MINING TIRES - FUTURE STATE



DEMAND PLANNING, CONVEYOR BELTS



Data Sources

Needed data for each use-case

At the end of the breakout sessions the group looked across all of the use-cases to understand what data sources would be needed to service potential near, mid, and long term solutions. The result of this exercise can be viewed in two ways:

The first is understanding which use-case has the smallest number of data dependancies and could therefore move the quickest toward delivery. In this view, the order would be scheduling & logistics, inspection, and ending with demand planning.

The second view would prioritize use-cases in which developing near-term data sources help jump start later use-cases. In this view the order would be, inspection, scheduling & logistics, then demand planning.

This outline is only a rough guide in helping to understand use-case prioritization. Deeper use-case into each solution would result in the details of each data source and additional dependencies.

Calendar

Key events and milestones through 2017 & 2018

JANUARY

- 15, Proposal from GE

FEBRUARY

- 2, Chairman meeting in Boston
- 13-20, Tire forum w/Rio Tinto

MARCH

- Conveyor belt forum w/Rio Tinto

JULY

- GE Digital Day, Japan
- GE Transform Conference

AUGUST

- Asia-Pac Mining Expo (AIMEX)

OCTOBER

- Bridgestone Solution Center Opening

NOVEMBER

- GE Minds & Machines Conference

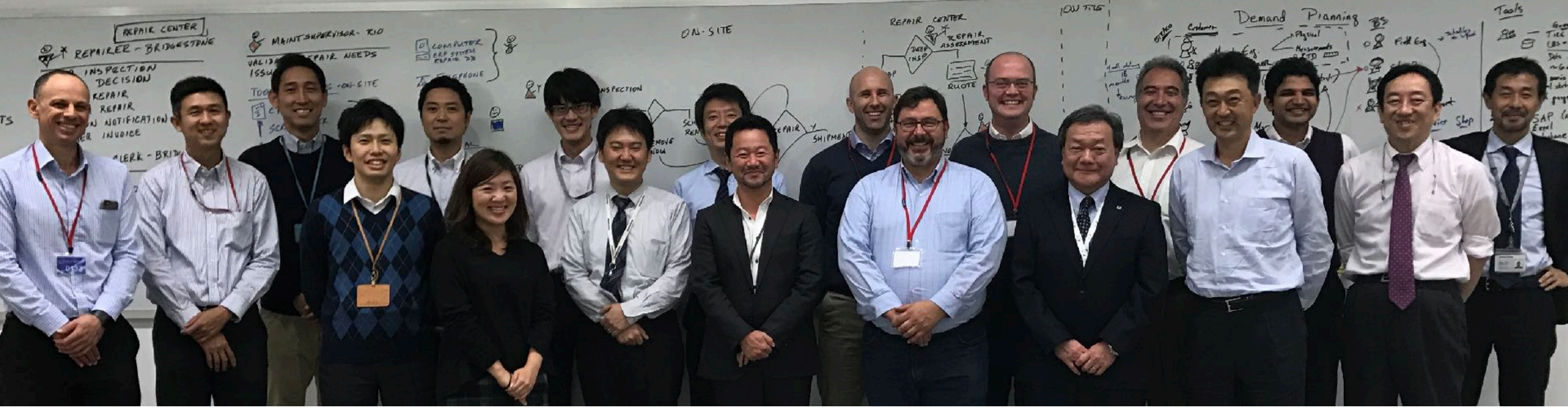
DECEMBER

- Tire supply contract renewal

2018

OCTOBER OTRACO New Contract

JUNE Conveyor supply contract expire


REPAIR CENTER
REPAIRER - BRIDGESTONE
INSPECTION
DECISION
REPAIR
REPAIR
NOTIFICATION
INVOICE
MAINT SUPERVISOR - RIO
ON-SITE
COMPUTER
ERP SYSTEM
REPAIR
TELEPHONE
INSPECTION
REPAIR CENTER
REPAIR ASSESSMENT
QUOTE
SHIPMENT
Demand Planning
Tools

Thank-You!