

Realizing smart supply chains by next-generation AI technologies

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Orchestrating a brighter world

NEC brings together and integrates technology and expertise to create the ICT-enabled society of tomorrow.

We collaborate closely with partners and customers around the world, orchestrating each project to ensure all its parts are fine-tuned to local needs.

Every day, our innovative solutions for society contribute to greater safety, security, efficiency and equality, and enable people to live brighter lives.

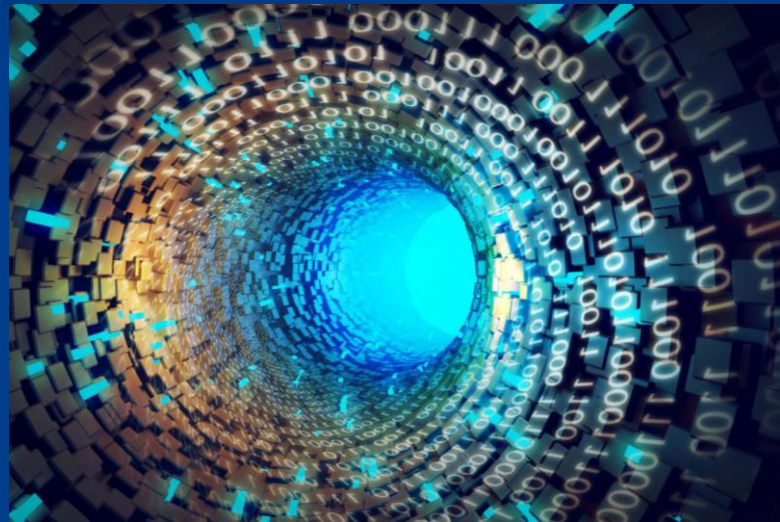
NEC's Quest for Social Value Creation

Digital industrial revolution through social value creation

7 Themes of Social Value Creation



Digital Industrial Revolution



History of Business by AI technologies

NEC has a technology portfolio and business track record that extends over half a century, including AI technologies that rank top around the world.

1960

1st Wave Recognition

OCR



Postal address sorter

Fingerprint Identification



Deployed by police worldwide

No.1
2004 to 2015

Face Recognition



Used in immigration control, etc.

No.1
2009, 2010
2013, 2017

2000

2nd Wave Prediction

SVM

Deep Learning

Human resource matching, etc.
(RAPID Machine Learning)

White-box Prediction

Hetero-generous Mixture Learning

2010

3rd Wave Control

Adaptive Distributed Control

Predictive Robust Optimization



NEC the WISE

AI technologies from NEC
for enriching human intellect and creativity

Solutions by IoT x AI in manufacturing industry

1st Wave
Recognition

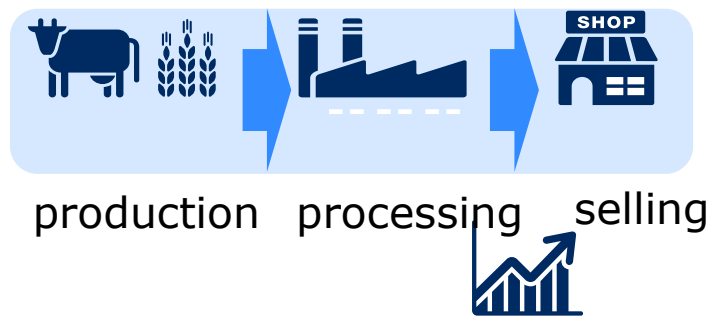
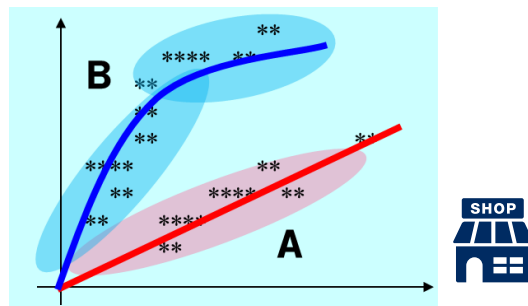
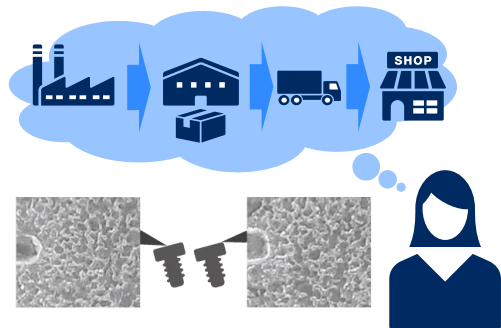
2nd Wave
Prediction

3rd Wave
Control

Traceability

Demand Forecast

Operation Plan



White-box
prediction

Predictive
robust optimization

History of Business by AI technologies

What is the NEXT WAVE?

1960

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OCR



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2nd Wave Prediction

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Deep Learning

Human resource matching, etc.
(RAPID Machine Learning)

Heterogeneous Mixture learning

Demand forecasting, etc.

2010

3rd Wave Control

Autonomous and Adaptive Control

Predictive Robust Optimization Framework



NEC the WISE

AI technologies from NEC
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History of Business by AI technologies

What is the NEXT WAVE? ⇒ Negotiation

1960

1st Wave
Recognition

OCR



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Heterogeneous
Mixture learning

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etc.

2010

3rd Wave
Control

Autonomous
and Adaptive
Control

Predictive Robust
Optimization
Framework



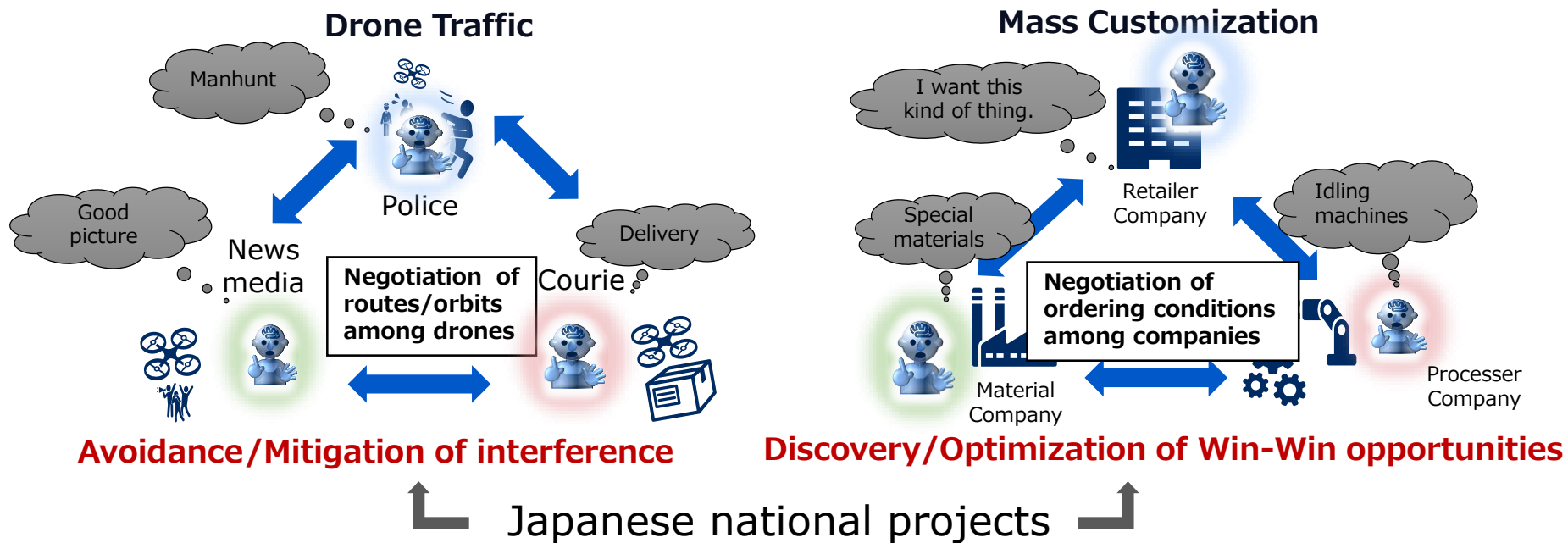
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for enriching human intellect and creativity

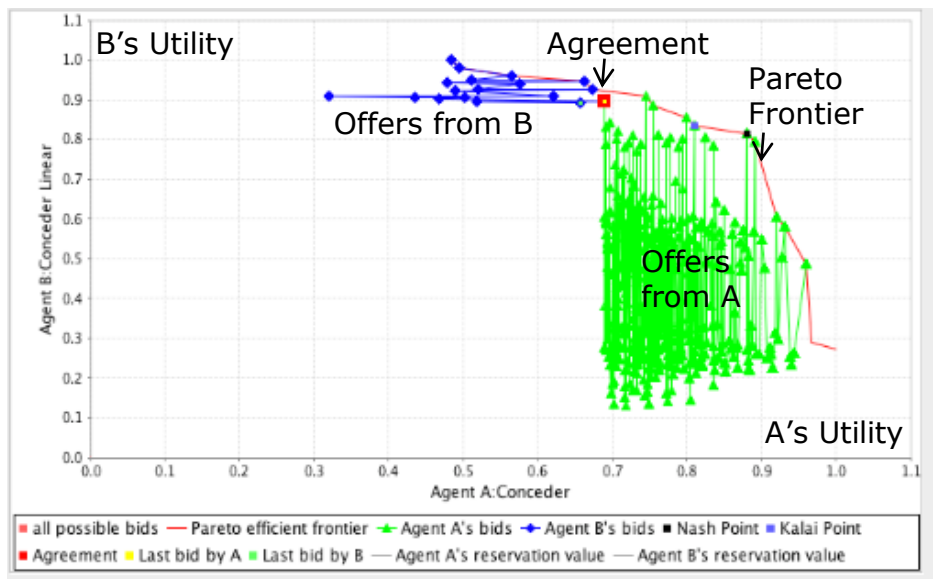
Coordination among AI Systems without central control

Economic Paradigm with greatly reduced coordination cost increases the value of Society 5.0 & Industrie 4.0

Finding mutually agreeable conditions by **Automatic Negotiations**



Automatic Negotiation AI



Egoistic Negotiation Agent

Maximizing own Utility

- Automatic Generation of Offering Condition
- Automatic Decision whether to Agree the Offer or not

Automated Negotiating Agent Competition (ANAC)

“Genius: An Integrated Environment for Supporting the Design of Generic Automated Negotiators”, <http://ii.tudelft.nl/genius/>.

Divide these objects between you and another Turker. Try hard to get as many points as you can!

Send a message now, or enter the agreed deal!

Items	Value	Number You Get
8	1.0	
1	1.0	
0	0.0	

Mark Deal Agreed ✓

Fellow Turker: I'd like all the balls.

You: OK, if I get everything else.

Fellow Turker: If I get the book then you have a deal.

You: No way - you can have one hat and all the balls.

Fellow Turker: Ok deal.

Type Message Here:

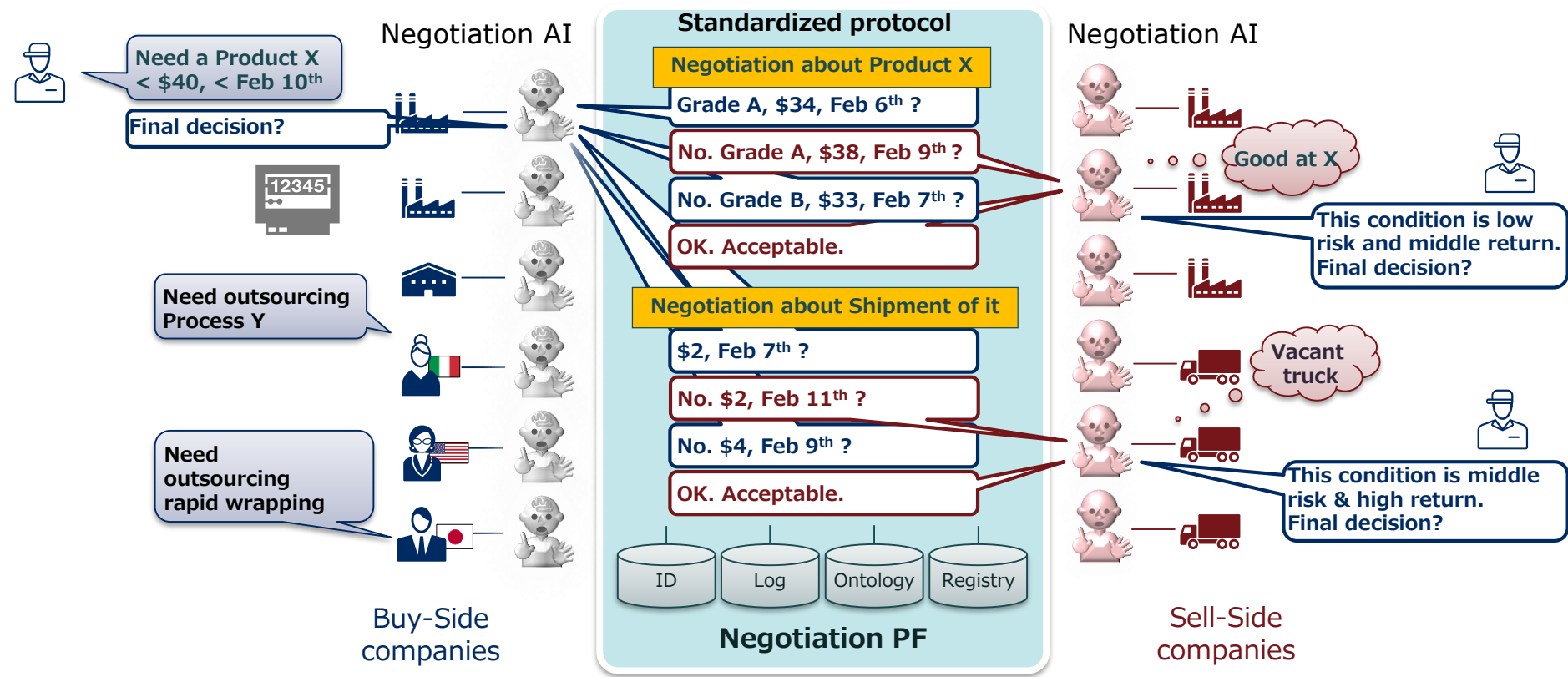
Message

Send

Press Release from Facebook

Lewis et. al., “Deal or no deal? Training AI bots to negotiate”, <https://code.facebook.com/posts/1686672014972296>.

Automatic negotiation on trading conditions



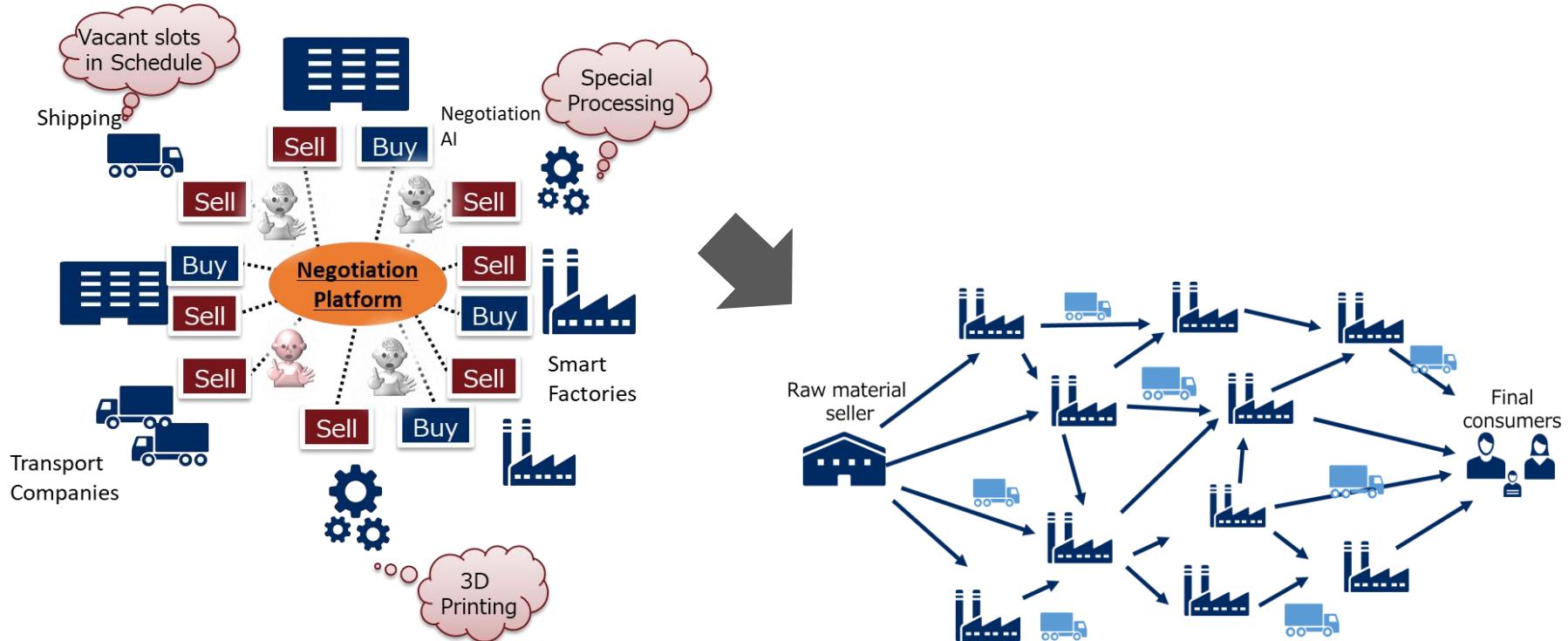
Market place for matching Win-Win relationships in mass customization economy

Smart supply chains by automatic negotiation

Factories and transportations are dynamically connected to form supply chains.

Sell-Side: Expansion of opportunities for orders and profits, making full use of assets

Buy-Side: Timely procurement of goods and services with best price



Strategic Innovation Promotion Program (SIP)

- Cross-ministerial Japanese national project
- Integrated R&D from basic study through to commercialization.
- 12 areas including AI, Energy, Deep Sea Development...
- Five-year project from FY2018. 30 billion Yen per year in total.
- RFP for "AI" area has a section "Coordination among AIs".

Our Project

"Improvement of efficiency & flexibility of supply chain through automatic negotiation"

Development of negotiation algorithm, user system, platform, protocol/standard, reference architecture, draft of legal system, experimental market

Leader:

NEC

Collaborator:

Toyota Tsusho, AIST, OKI,
Tokyo University of Agriculture and Technology
University of Tokyo, Chuo University,
Nagoya Institute of Technology

Advisor:

20+ entities from industry & academia including German

FY2018: Use-case definition

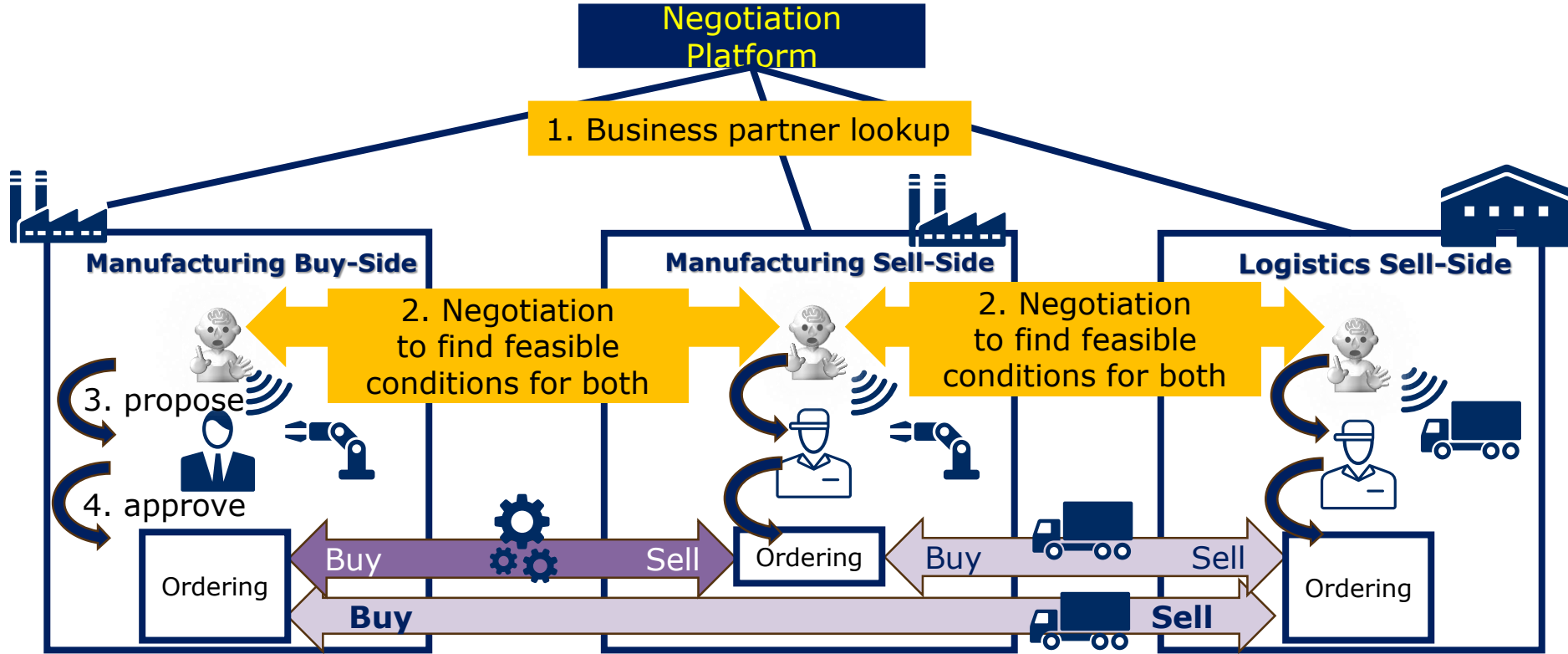
FY2019: Simulation Demo

FY2020: Minimum operation

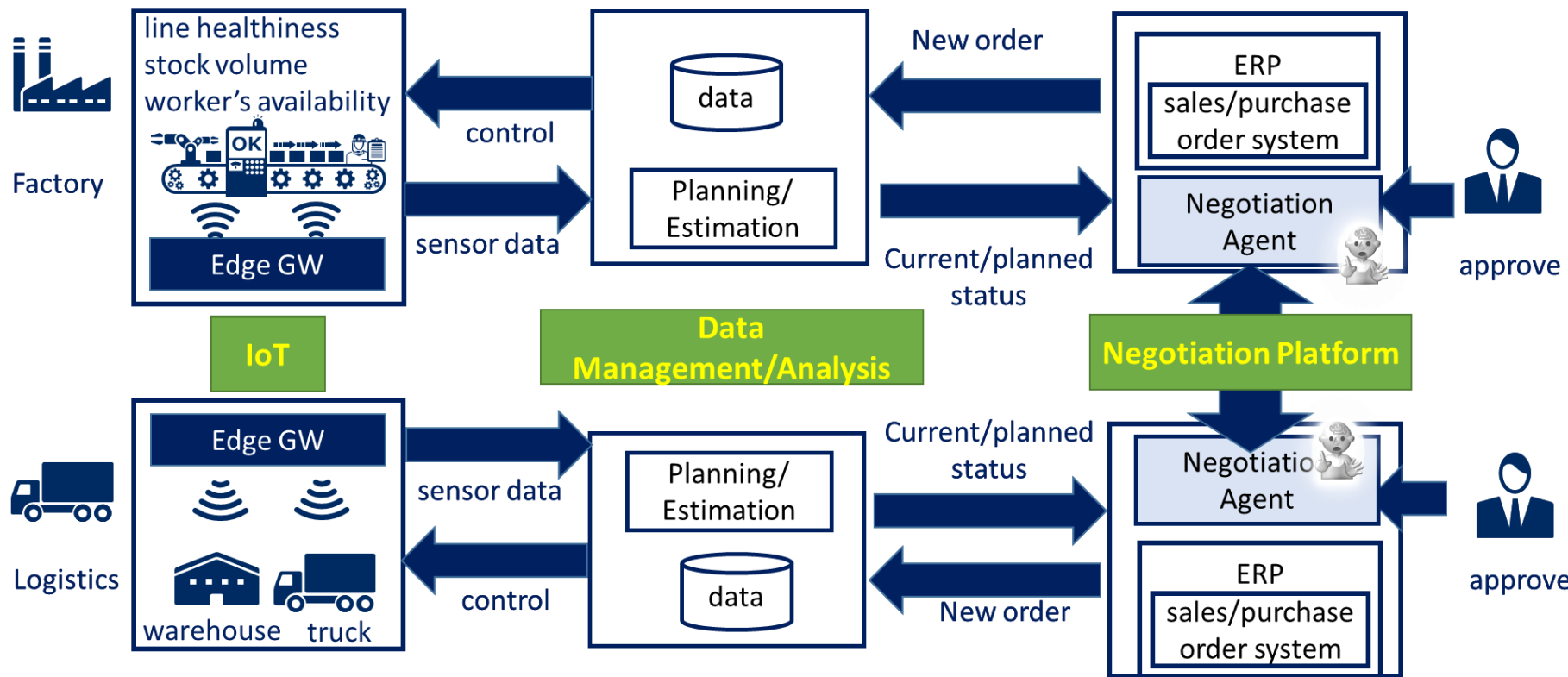
FY2021: Practical Operation

FY2022: Experimental market

Solution overview



Architecture Overview



Outreach activities

Industrial Internet Consortium (IIC)

We are proposing Negotiation Automation Platform as an IIC testbed.

- Standardization for interoperability among negotiation AIs
- Reference architecture and reference implementations as open source
- Open Collaboration including Fraunhofer IOSB

Automated Negotiating Agent Competition (ANAC)

We are organizing Supply Chain Management League

- ANAC is a competition ran by the academic community on automatic negotiation from 2010.
- SCM League is new from 2019, aiming a bridge across industrial and academic community.
- Simplified mathematical model of smart supply chains by automatic negotiation.

Call for collaboration

We welcome collaborators who are willing to work with us on this project.

- SIP project advisor
- IIC testbed “Negotiation Automation Platform” participant
- ANAC “SCM League” participant
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 **Orchestrating** a brighter world

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