

Let's decide the concept first!

—To decide the concept—
(RAMS Phase 1)

Mori Takashi

National Traffic, Safety and Environment Laboratory,
National Agency for Automobile and Land Transport Technology, Japan

Actors



President of Hippo Corp.
(Headquarter: Osaka)
Motto: Technology and inspiration



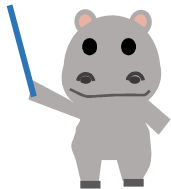
Kabao
Sales, Hippo Corp.
Comment: Absorbing someone's anger
makes my wage. Ice cream heal me.



Manager of
Electric Dept., Hippo Railway
Motto: Bring inexpensive and better
one!



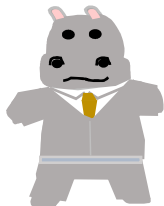
Otakaba
Engineer, Hippo Corp.
Motto: No fun, No engineering!



anonymous Hippo
Unknown Consultant
Motto: Knowledge is power!



hacking Hippo
Planning & Implementation, Hippo Corp.
Motto: I make the way which no one else can
realize.



Prof. Ohkaba
Motto: Software must be in good
order.



Yokokaba
Quality Control Dept., Hippo Corp.
Comment: You can see truth when you look
sideways.



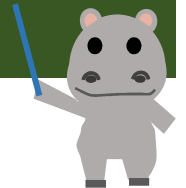
Employee of an affiliate company of
Hippo Corp.
Comment: Affiliates always must say "YES,
Sir!"

Previous summary

- RAMS stands for Reliability, Availability, Maintainability and Safety.
- The RAMS standard is NOT for skilled executives.
- The purpose of the RAMS standard is NOT to get the certification.
- It is a mechanism that allows you to succeed in reaching the expected RAMS goals.
- The important thing to follow is V&V and traceability.

Agenda

- 1-1 What is the concept?
- 1-2 Example in this seminar
- 1-3 Define the system scope and purpose
- 1-4 Understand the surrounding situation
- 1-5 Understand the RAMS requirements of the system roughly
- 1-6 Take costs and precedents into consideration
- 1-7 On the basis of the existing systems, reconsider if we can make it
- 1-8 Define the scope of requirements to be controlled



1-1 What is the concept?

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1-2 Example in this seminar

1-3 Define the system scope and purpose

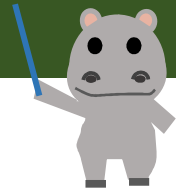
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1-1 What is the "concept"?



"Concept" is really important, I think. Guys! Conceive the "concept" as much as you can.

What's a concept? I can't communicate in English.



A concept is a general idea! In Korean, no concept (개념없다) means no common sense.

I'm afraid I also don't understand Korean.

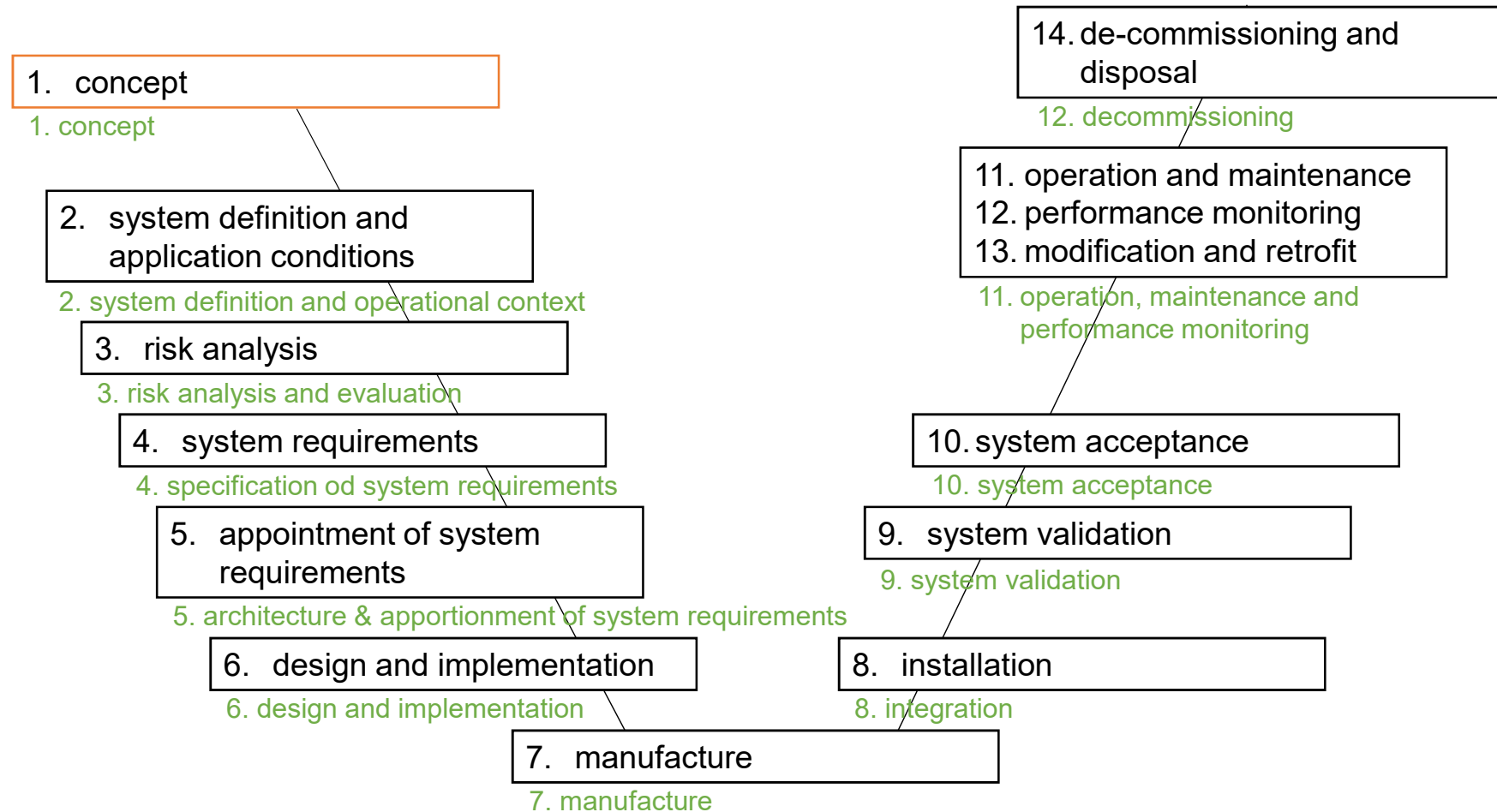


Well, if I were ordered to establish the concept, I may not know what to do.



Isn't it about examining the system as to what it should be in order to continue designing, manufacturing and operating?

1-1 System life cycle



1-2 Example in this seminar

1-1 What is the concept?

1-2 Example in this seminar

1-3 Define the system scope and purpose

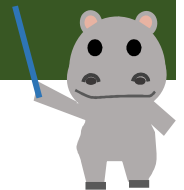
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1-2 Example in this seminar



Oh, an another big problem....

What can I do for you?



Although we Hippo Railway introduced electronic interlocking systems, similar equipment was lined up at each station. Our president said to me, "You should propose better ideas. Can't we manage them by centralized interlocking system? Why do we need the train supervision system other than the interlocking?"

(Oh, no! Those are our products.) So, what's on your mind? Please tell me your idea.

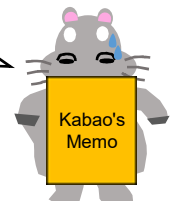
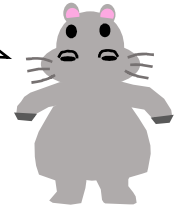


If Hippo Corp. developed **a highly centralized interlocking system that could control everything at the operation center**, that would solve the problem.

Centralized interlocking. Yes, Sir!



Really inexpensive one, please. I count on you, Kabao.



1-3 Define the system scope and purpose

1-1 What is the concept?

1-2 Example in this seminar

1-3 Define the system scope and purpose

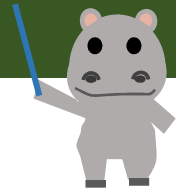
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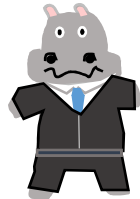
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1-3 Define the system scope and purpose

—In the office of Hippo Corp.—

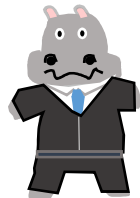


I'm back. Hippo Railway asked us whether we can propose the centralized interlocking system that can be controlled at the control center.

I'm not following you, Kabao. If we don't know what they think and what they want to do, we can't make a proposal.

They said, "Really inexpensive one." I think that's what they think.

"Similar interlockings are in everywhere which is confusing and meaningless," they said. "Why do we have to go around the sites one by one? It's a pain in the neck."

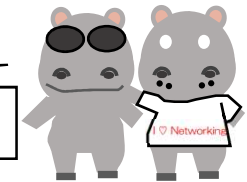
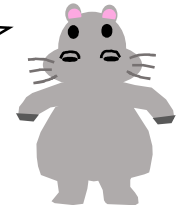
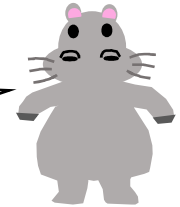


You only heard their words in fragments. It cannot be helped. Anyway, we have to think about that information a little, and imagine what they think before visiting them to ask.



Hey Otakaba and hacking Hippo! Imagine what they think from what Kabao said, and make a proposal.

Just this? All right, boss.



1-3 Define the system scope and purpose

—In the office of Hippo Corp.—



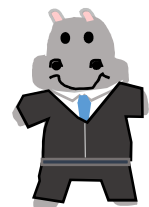
Well, I have very little information, but somehow I understand what they mean.

I believe you can make it easily. I will give you a Hippo brand ice lolly.



In short, I should illustrate a schematic diagram of a centralized interlocking system and its quotation, too.

Oh yes, hacking Hippo. You are genius!



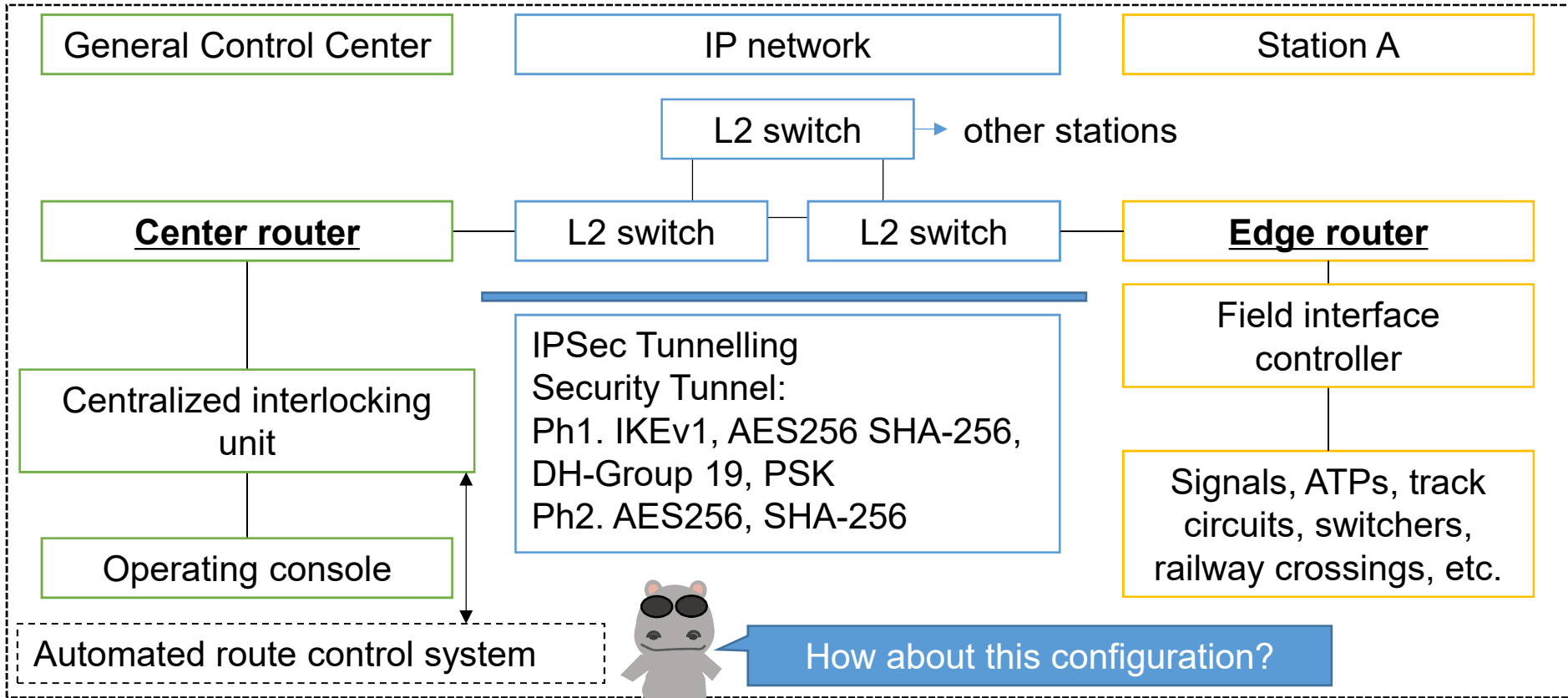
Right! The key trend is PoCs*. The quick cycle of testing a hypothesis, learning from early results, and implementing solutions makes companies stronger. Agile development! It was in yesterday's Hippo Industrial Newspaper.



I have a very bad feeling about this. I can easily imagine that Kabao would be scolded by the Manager of Electric Dept. of Hippo Railway.

* PoC: Proof of concept

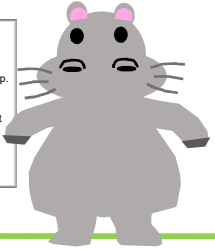
1-3 In case of making the configuration before the concept is established



What's this?
I can't understand.

I brought our quotation.

Quotation
Electric Dept.,
Hippo Railway,
Hippo Corp.
We are pleased to quote as follows:
System development cost: JPY 30,000,000



1-3 Example of basic approach

Hippo Railway introduced an electronic interlocking ("EI") system, which requires no complicated wire logic design, to replace an all relay interlocking ("ARI") system for each station.

Because the complexity of the logic is not directly proportional to the size of the EI system, which is different from the ARI system, the EI system only requires small space of the equipment room at a big station.

In order to make better use of these features, instead of installing the EI system at each station, a centralized EI logic unit is set up at a hub station or command center, and only interfaces between equipment are installed at each station. This is called a centralized interlocking system.



Enables to focus on maintenance works.

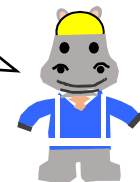
Enables to reduce costs.

As for the assumed availability, the same level as the current level shall be secured, and the same level as the current system shall be guaranteed in the life cycle.



This is our proposal. Please let us know if there are any problem.

Generally it's OK. Let's discuss in detail.



1-3 Purpose of this system



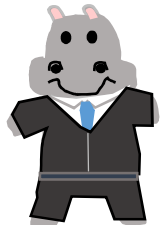
What is the purpose of this system?



The purpose is to downsize the equipment along the railway lines, prioritize maintenance, and reduce costs by centralizing the complicated interlocking logic.



Therefore, centralized interlocking.



How do we achieve that? Also, price reduction without cost reduction means lower profits.



Well, that's our topic. Let's discuss!

1-3 Scope of this system



What is the scope of this system?



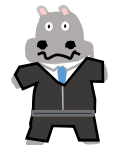
The scope is our interlocking logic unit "KABA-X interlocking" and interface equipment at each station, called "KABA-FC1".



What about the network in between?



....



We'll be in trouble later if we don't decide how much we will be responsible.

That's exactly what our president says! If we don't decide on that, I am the one who will be blamed for any problems in Hippo Railway. It's important to specify the scope of the system.



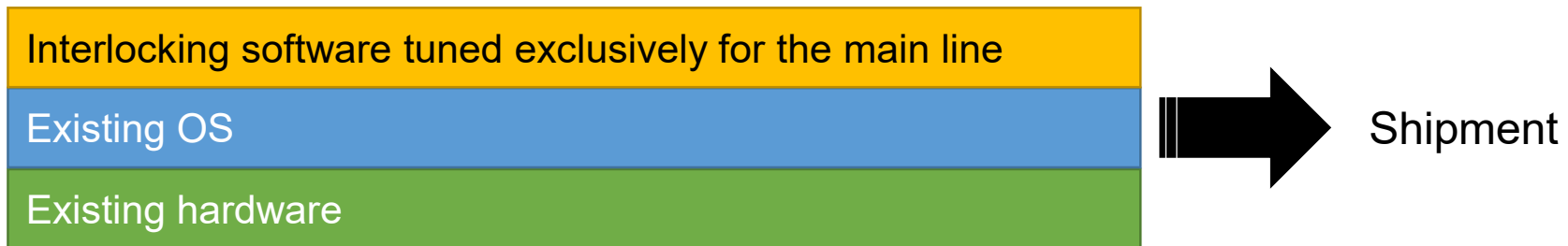
1-3 If the system scope is not clearly defined



Hacking Hippo, Hippo Railway has asked me to realize the proposed centralized interlocking system real quick. They want it by all means. They want us to say "yes". Just for one specific line operated by them.



Are you sure? If it's really for one specific line, we can do it.



Osaka Railway, which uses our products, requests us for the similar centralized interlocking system. They want it now. This is a little larger scale, though.



No! That's impossible! It's only for the specific line operated by Hippo Railway. We promised.



That's NO GOOD! Why did you set the system scope that way?

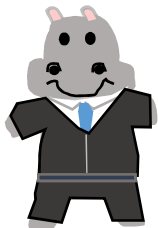
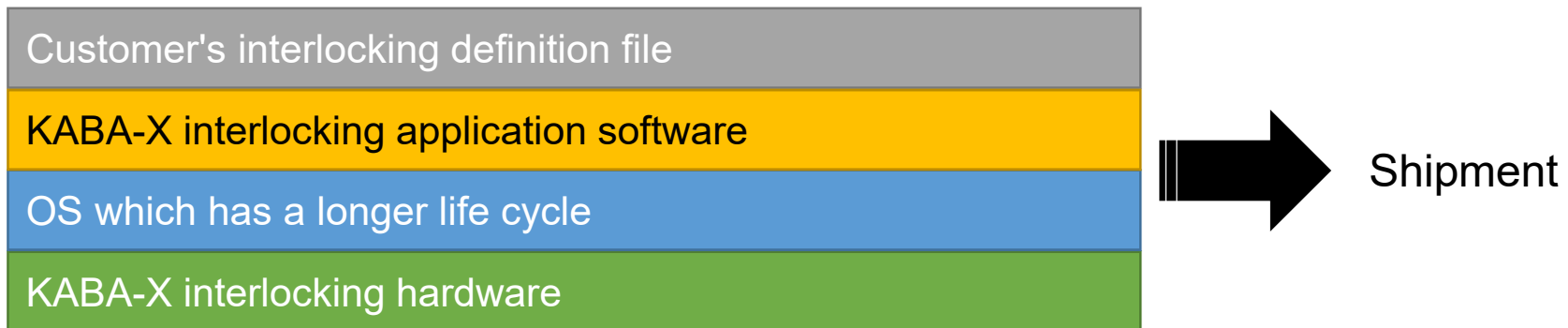
1-3 If the system scope is appropriately defined



What is the scope of this system?



The scope is our interlocking logic unit "KABA-X interlocking" and interface equipment at each station, called "KABA-FC1". These are designed as systems that can be used by many railway operators. Circumstances specific to each railway operator and corresponding interlocking are defined by means of a setting file. In order to support various network types, network equipment may be provided by Hippo Corp. or by the applicable customer in collaboration with a telecommunications carrier. This is designed for the maximum 300 routes.



If the above is in place, we can ship the product right away when other railway operators such as Osaka Railway request us the same system.

1-4 Understand the surrounding situation

1-1 What is the concept?

1-2 Example in this seminar

1-3 Define the system scope and purpose

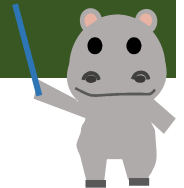
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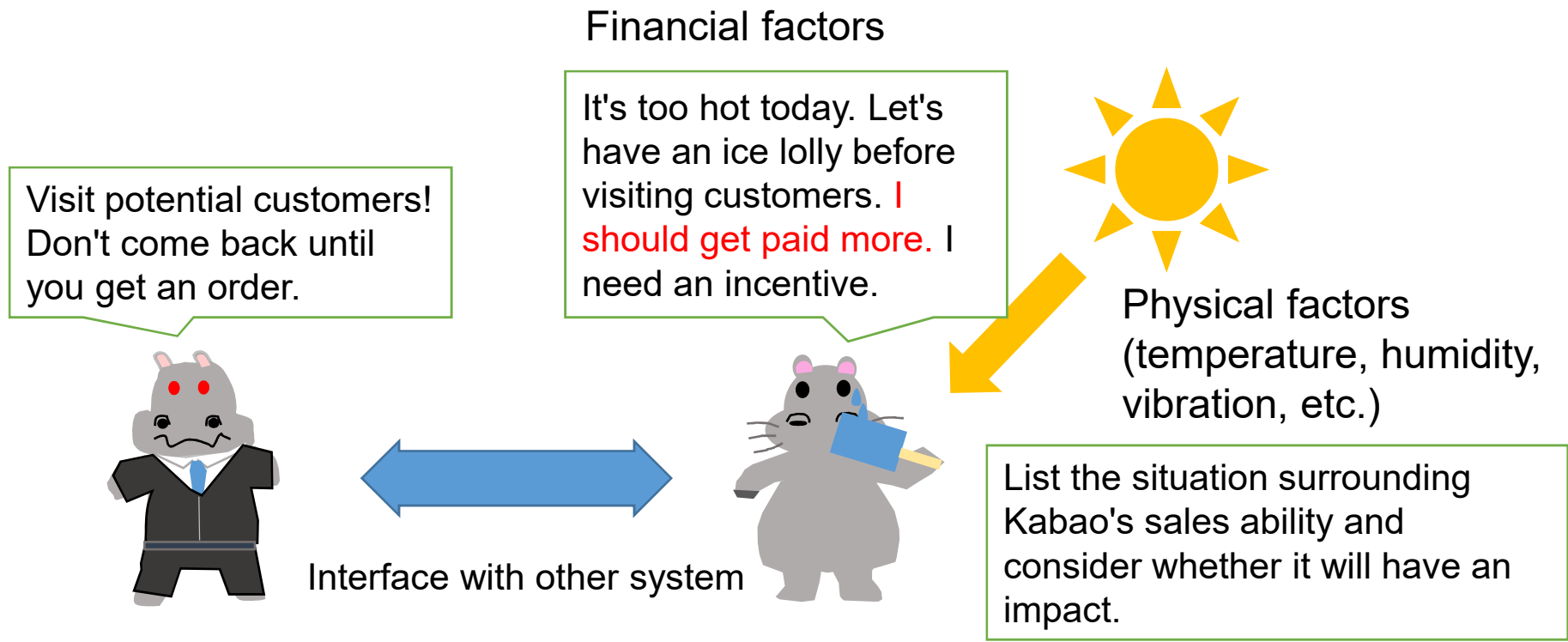
1-8 Define the scope of requirements to be controlled



1-4 Understand the surrounding situation

This page is a joke.

What's wrong with this?



1-4 Understand the surrounding situation

Prepare a model. List as many factors as you can think of. Understand the surrounding situation which may influence RAMS.



Any physical factors?



It may get hot in the equipment room.
High vibration acceleration.
The power source may be unstable. Hacking risks....

Try to think about what the circumstances are and what their implications are.

1-4 Notes for understanding the surrounding situation (No mark?)



Any physical factors?



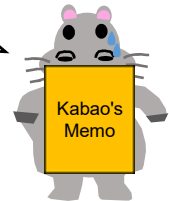
It may get hot in the equipment room.
High vibration acceleration.
The power source may be unstable. Hacking risks....



Kabao, make a list of these factors and submit it to the customer.

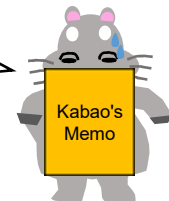
Yes!

~ Later ~



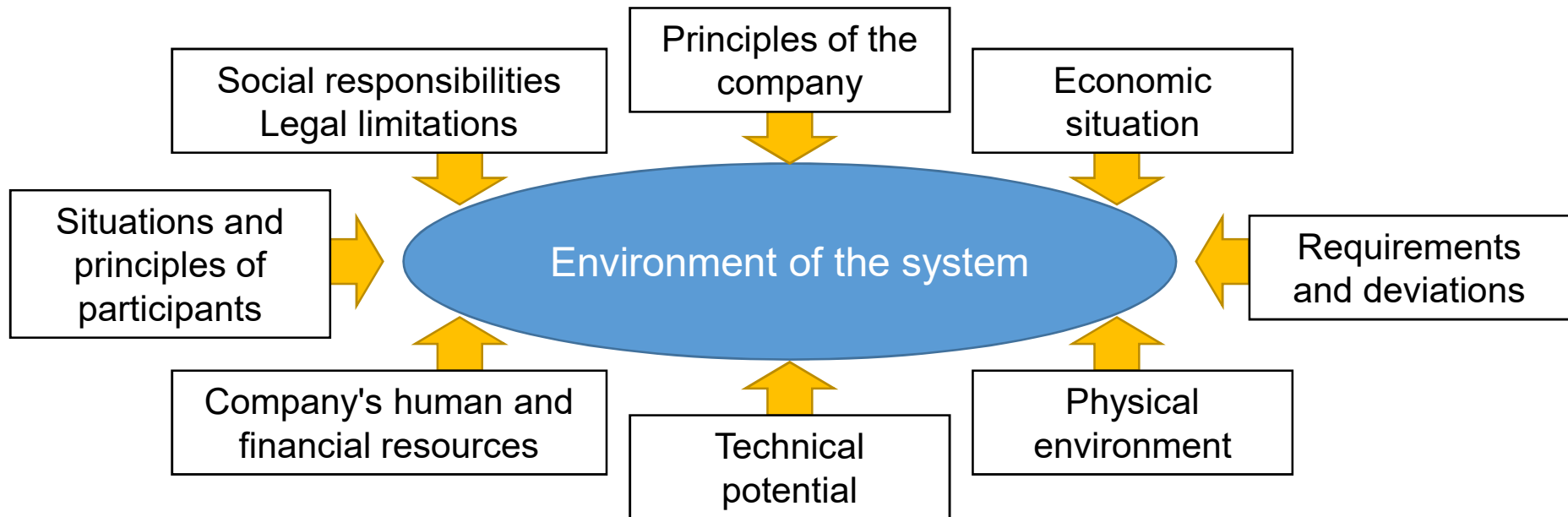
You worry about operations of this system, but what about the maintenance?

We are reporting concerns. We won't report anything that is OK.

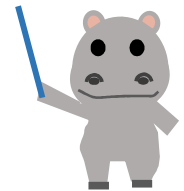


It's hard to distinguish it from the ones that haven't been considered. If it's OK, write it's OK.

1-4 Proposed model for understanding the situation

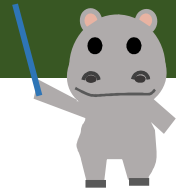


This is just an example, so please discuss what situations you need to consider. Also, record the items that do not need to be considered.

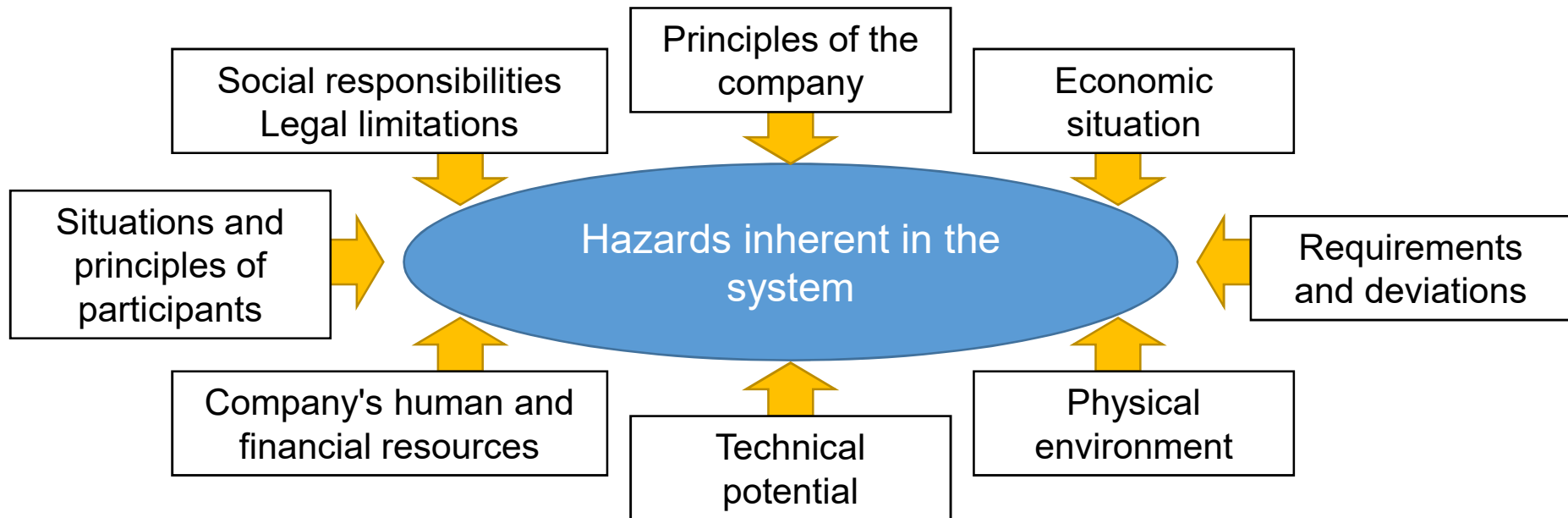


1-5 Understand the RAMS requirements of the system roughly

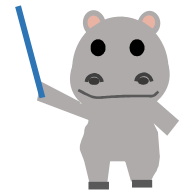
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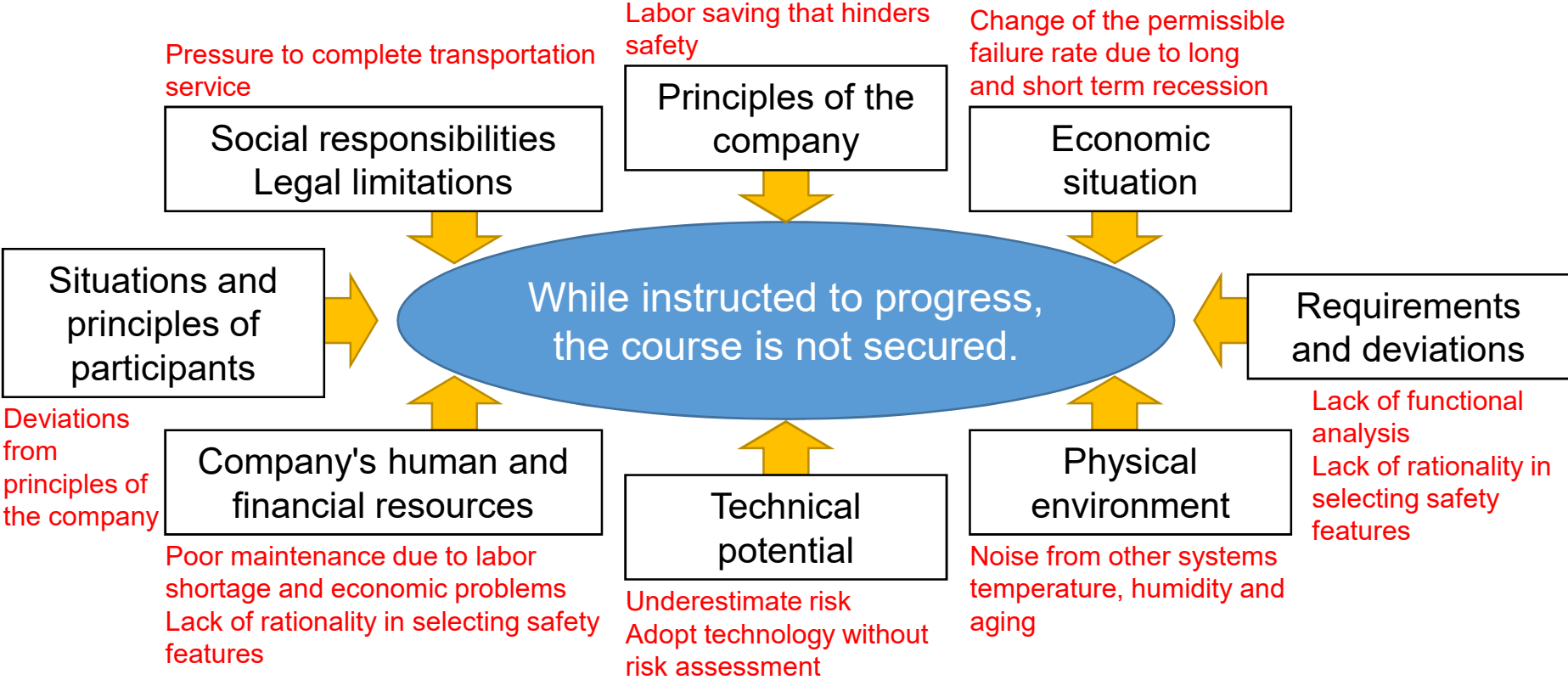
1-5 Identify potential sources of hazards



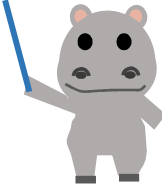
Find the items that are likely to be a source of hazards for centralized interlocking system.



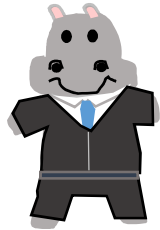
1-5 Identify potential sources of hazards



Requirement 3 of the phase 1: Concept (6.1.3.3) in IEC 62278 is to "identify sources of hazards which could affect the RAMS performance of the system, including: interaction with other systems; interaction with humans." Because we cannot know about the internal configuration at this stage, let's focus on the outside of the system.



1-5 Understand the RAMS obstructions and requirements



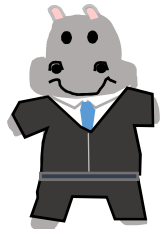
Today, let's discuss about Hippo Railway situations, and guess what they are thinking. From the surrounding situation examined, you can probably guess what they are looking for in this system, interfaces to others, the reliability of operators, availability, maintenance and safety policies.



Well, since Hippo Railway is profitable, they will update the equipment in about 15 years, but for Piggy Railway, they will use it for about 25 years. So, we have to think about that much maintenance.

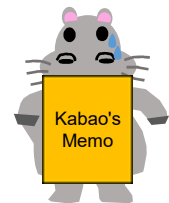


Considering the sources of hazards, make sure to keep the basic idea firmly, especially to emphasize the clarification and rationality of the safety function decision, to conclude a maintenance contract because it is necessary to follow the maintenance cycle. It seems necessary for safety not to fall below the existing level.



Yes, our proposal must contain 20 years of maintenance contract, hot standby redundancy, and the same level of safety as the current interlocking system. Kabao, go and negotiate with Hippo Railway.

I understand.



1-6 Take costs and precedents into consideration

1-1 What is the concept?

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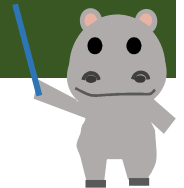
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1-6 Making a profit is very important



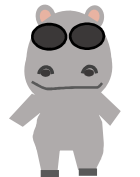
Can you estimate how much the interlocking system for the specific line operated by Hippo Railway cost?

I think it cost about 300 million yen for 10 stations. The CTC system itself was about 50 million yen.



So how profitable was that project?

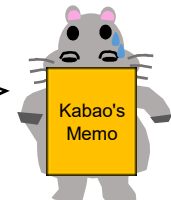
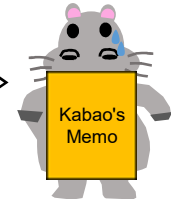
We had a final profit of 35 million yen. Please raise my salary. This half is enough.



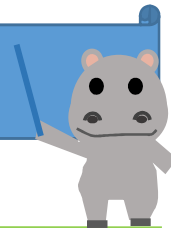
It will be about 130 million yen at cost, and I think it's okay to make about 50 million yen. In that case, we have to propose that it will cost at least 180 million yen. Then, why don't we make an estimate at a cost not to exceed 250 million yen, which is 100 million yen lower than before?



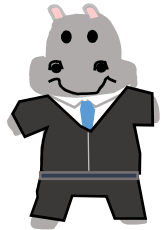
Well, let's make a win-win situation so that both Hippo Railway and our company can make a profit.



First, let's clarify the restrictions.

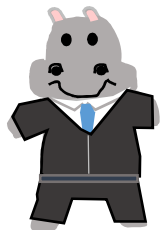
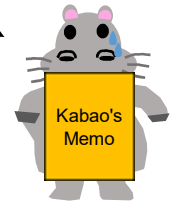


1-6 Cases of similar items



Does Hippo Railway have any problems with a similar system?

Printed Circuit Boards and power sources seem to be replaced within 15 years due to the surge in failure rates.

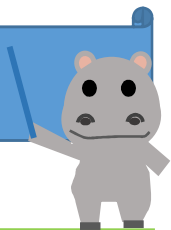


This means that the system needs to be replaced once in order to last for 20 years. It is assumed that it can be replaced without upgrading the function.



Our budget gets tighter. If we don't talk about this, we'll have trouble. The problem is the Piggy Railway, which use up the system to the end.

Let's clarify the restrictions from similar items.



1-7 On the basis of the existing systems, reconsider if we can make it

1-1 What is the concept?

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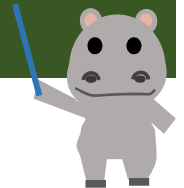
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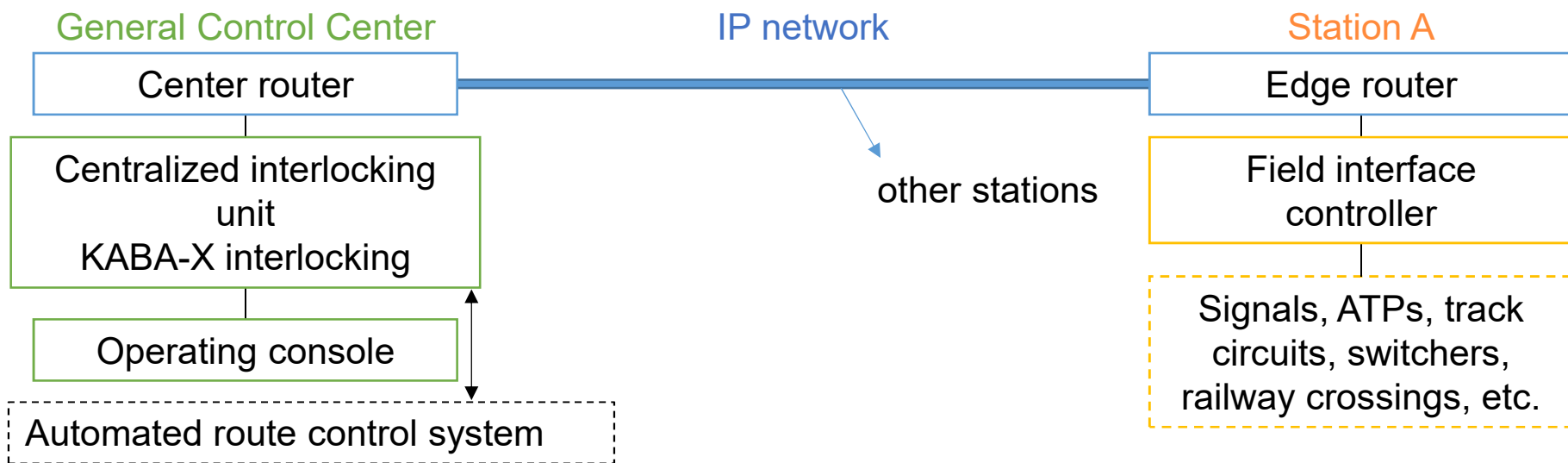
1-7 Review if we can make it



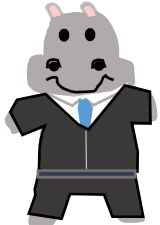
What is the purpose and scope of this system?

The purpose is to prioritize maintenance and reduce costs by providing **the logic unit of the interlocking system collectively** at the command center and installing only the interface parts of each equipment at each station. **The solid line is within our scope**, the dotted line is out of our scope, and the blue line is the part that the customer may arrange.

For the equipment surrounded by the blue line and the dotted line, clarify the requests to the customer, so that it consists in conditions of use.



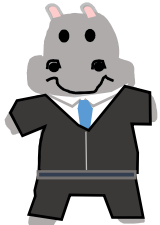
1-7 Review if we can make it



What is the outline of the RAMS requirements for this system?



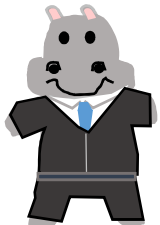
We haven't decided yet, but I think as follows:
Maintenance contract is 20 years; redundancy is hot standby; and safety and availability is equal to or higher than the existing one.



What is the replacement cycle? What is the selling price?



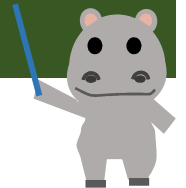
We haven't decided yet, but I think as follows:
Printed Circuit Boards and power sources are to be replaced in 15 years;
The initial investment is to be 180 million yen or more and 250 million yen or less;
The merit for customers is that the initial cost is 100 million yen or more, and the maintenance cost is 100 million yen in 20 years.



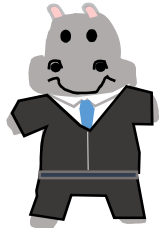
This gives us the prerequisites we need to handle.

1-8 Define the scope of requirements to be controlled

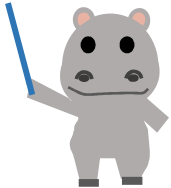
- 1-1 What is the concept?
- 1-2 Example in this seminar
- 1-3 Define the system scope and purpose
- 1-4 Understand the surrounding situation
- 1-5 Understand the RAMS requirements of the system roughly
- 1-6 Take costs and precedents into consideration
- 1-7 On the basis of the existing systems, reconsider if we can make it
- 1-8 Define the scope of requirements to be controlled**



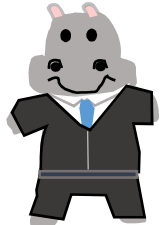
1-8 Management to carry out what you have decided



Should I take the lead in following the prerequisites?



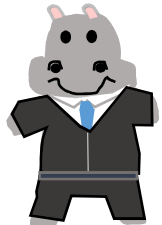
Strong leadership is good, but that's not enough. It is necessary to determine a mechanism for what role to create safety and reliability as a plan and verify its implementation. I guess you learned from identification of potential sources of hazards.



Well, that also makes sense. But isn't it difficult?



Why don't we make up for what is missing from our current rules? First of all, I think it is better to make sure that the concept and specifications are not inconsistent, the method for determining safety requirements, and whether the specifications and deliverables match.



That sounds nice.

Conclusion

1-1 What is the concept?

Isn't it about examining the system as to what it should be in order to continue designing, manufacturing and operating?

1-2 Example in this seminar

Centralized interlocking is taken as an example.

1-3 Define the system scope and purpose

If the scope or purpose fluctuates, the specifications will change steadily.

1-4 Understand the surrounding situation

It is related to safety specifications, but you can see what kind of rules and management methods are needed.

1-5 Understand the RAMS requirements of the system roughly

Continuing operation requires not only safety but also how much labor is required.

1-6 Take costs and precedents into consideration

It is a big factor in whether or not the project should be carried out. Let's do it from the beginning.

1-7 On the basis of the existing systems, reconsider if we can make it

Make sure that the existing concepts are not in conflict with each other.

1-8 Define the scope of requirements to be controlled

It is necessary to follow the methods for eliminating hazards and to comply with constraints.

