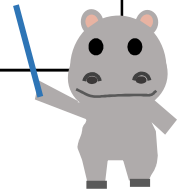


# #1: The Railway International Standards - For whom and why are they existing?

(Through RAMS standard)

RAMS stands for  
Reliability,  
Availability,  
Maintainability  
and Safety



Mori Takashi

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

# Objectives

- For most railway affiliated members, the purpose of the RAMS standard is to "confirm a product and get a certification". How do you think?
- My point of view is a little different. When we realize something, standards tell some good practices for this.
- Maybe some of you are thinking "I have NO relationship between I and international standards, because I can work without them". Yes, you are right.
- But if you find something better for your work in the standards and use them partially, it will be my pleasure.

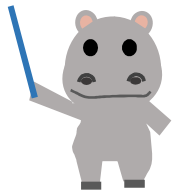
# Actors



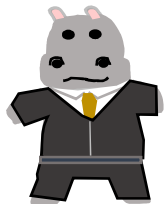
President of Hippo Corp.  
Motto: Technology and inspiration



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



anonymous Hippo  
Unknown Consultant  
Motto: Knowledge is power!



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



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



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



hacking Hippo  
Software developer, Hippo Corp.  
Motto: I make the way which no one else can realize.



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



Kabami  
Executive Engineer, Hippo Corp.  
Motto: Let's work together.

# Introducing myself

Hometown: Kobe, Japan

My favorites: Hippos, breads, cakes, puddings, oranges

- Joined West Japan Railway Company in 1992
  - 2 years for signaling maintenance work, 3 years for construction engineer, and 23 years for R&D engineer
    - In the fields of IP network, train radio, gauge changeable train and CBTC
- Appointed as a visiting professional researcher from National Railway Certification Center (NRCC), NTSEL, NALTEC, Japan in 2018
- Joined NRCC as a senior researcher in 2021

# Agenda

0-1 Why do standards exist?

0-2 Purpose of RAMS standard

0-2-1 What the standard aims for

0-2-2 What is often misunderstood

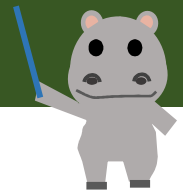
0-2-3 To whom it is needed?

0-2-4 What it can and what it cannot

0-3 Basic technology regularly used in the standard

0-3-1 Verification and validation (V&V)

0-3-2 Traceability



This is the introduction stage, where the numbers start from 0.

Please refer to the numbers starting from each stage of the standard from now on.

# 0-1 Why do standards exist?

## 0-1 Why do standards exist?

### 0-2 Purpose of RAMS standard

0-2-1 What the standard aims for

0-2-2 What is often misunderstood

0-2-3 To whom it is needed?

0-2-4 What it can and what it cannot

### 0-3 Basic technology regularly used in the standard

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Paradoxically, why do Japanese companies find management methods such as ISO 9001 annoying?

# 0-1 We are a group of members with high ability!

We, "Hippo Corporation", are a group of members with extraordinary talents. Everyone is skillful. We are proud of our human resources, although we are not humans but hippos. Anyway, we are always ahead of other rivals.



We are looking forward to your company. We, Hippo Railway, are thinking of adopting your cutting edge ATP system. By the way, nowadays, I heard that we have to think about the RAMS international standard. What is that? It seems to be difficult to deploy.

Yes, we are having a hard time to follow. The standard does nothing but harm, because it requires a lot of documentation to describe same and obvious things again and again, and third parties are always claiming our work. Since we are highly-skilled members, we can do properly without making documents. We understand the whole thing by just listening to a piece of information. This is the motto of Hippo Corp. It that right, Kabao?



Uh, yes sir. (But I need some documents that I can refer to.)



# 0-1 Workforce is not eternal!



Let me introduce myself. I am a freelance consultant "anonymous Hippo". In an IEC standard, the assignment of roles of persons shall be in accordance with requirements throughout the lifecycle\*. How are you doing at Hippo Corp.?



We never transfer employees, so their roles are never changed.



OK, then how long is the lifecycle of ATP system?

It's 20 years, but the Hippo Railway may keep using it for 40 years.

And, the normal life span of hippos is 50 years or so. Are you OK?

Shut your mouth! Our members keep working until they are died. If someone quits, he/she is a betrayer. we can maintain systems without documentation, because no one can quits.

Kabao, you must have a full medical checkup once a year at the expense of the company.

Maybe we cannot find any medical checkup programs for hippos.





# 0-1 Skillful members' opinions for RAMS

What do you think about the RAMS standard?

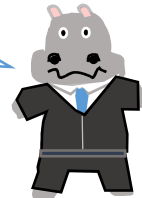


Huh. I cannot find any good points. It forces us to write obvious things again and again. I know the important points to realize the system without documentation. So, if you ask me, I will answer immediately.



Because I am excellent in programming, I always minimize bugs. I never need managements. It's meaningless to me!

These answers are exactly as I expected. Now, I am confident that we don't need the RAMS standard.



A few months later,



**We decided to quit Hippo Corp. and move to Piggy Corp. that promises to pay more! Thank you for a long time!**

No way! I have no idea regarding the version control of specifications or programs. I am the one who will be scolded by customers.



For companies, skillful members and personal competences are important, but documentation is the scope of work for everyone. The RAMS standard regards documentation as to inherit to other members easily.

# 0-2 Purpose of RAMS standard

0-1 Why do standards exist?

## 0-2 Purpose of RAMS standard

### 0-2-1 What the standard aims for

0-2-2 What is often misunderstood

0-2-3 To whom it is needed?

0-2-4 What it can and what it cannot

0-3 Basic technology regularly used in the standard

0-3-1 Verification and validation (V&V)

0-3-2 Traceability

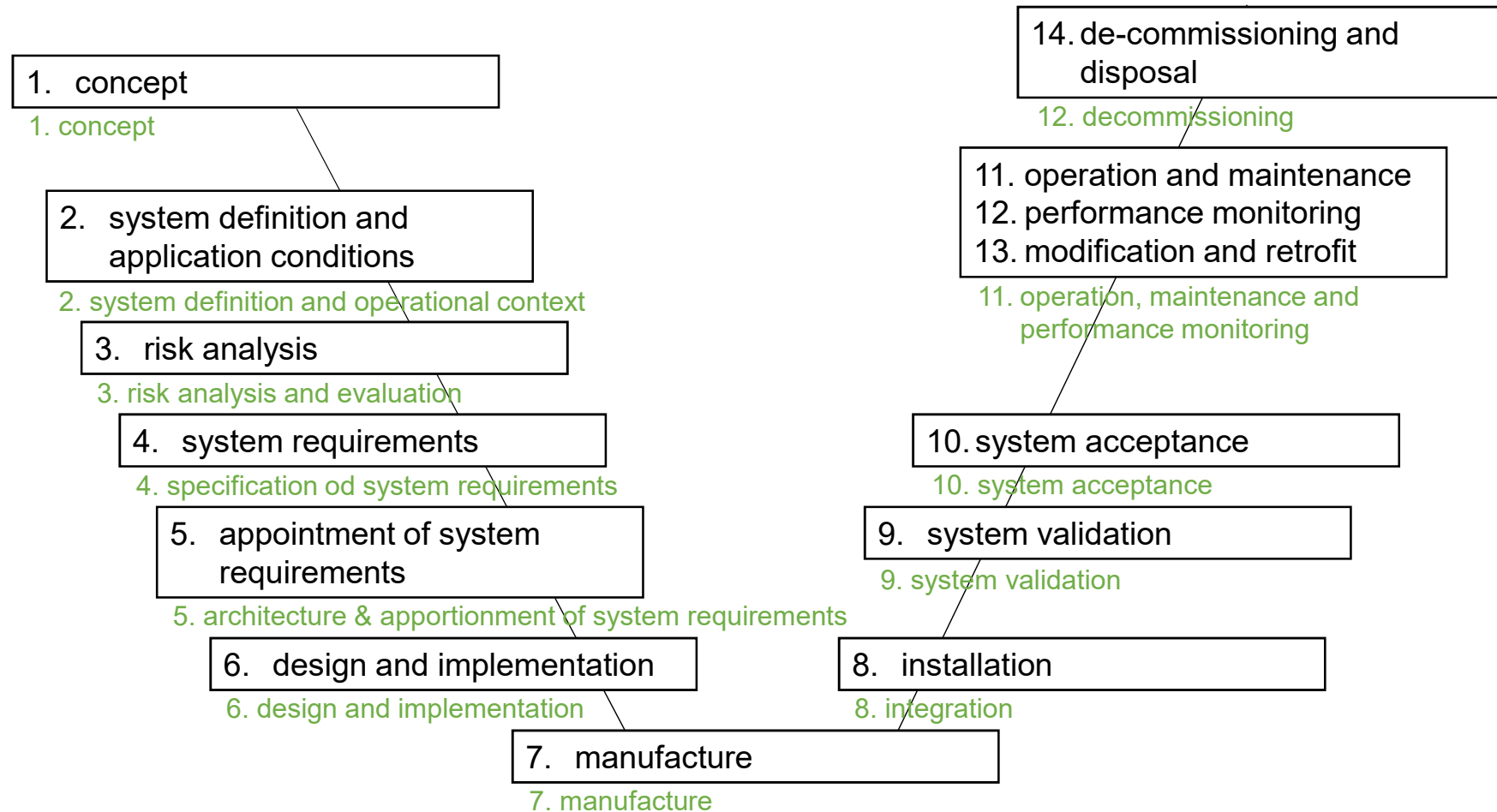


# 0-2-1 What the standard aims for

- *This standard can be applied systematically by a Railway Authority and railway support industry, throughout all phases of the life cycle of a railway application, to develop railway specific RAMS requirements and to achieve compliance with these requirements.*

To put it simply, if you apply this standard, you can design, manufacture, deploy and remove the system correctly, consistent with the requirements.

# 0-2-1 Life cycle phases



# 0-2-2 What is often misunderstood

0-1 Why do standards exist?

0-2 Purpose of RAMS standard

0-2-1 What the standard aims for

**0-2-2 What is often misunderstood**

0-2-3 To whom it is needed?

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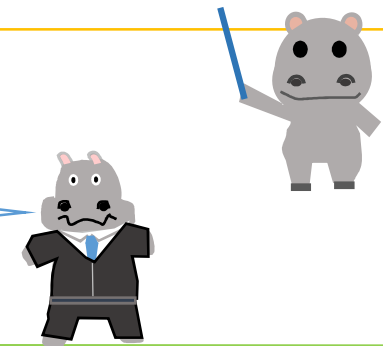
# 0-2-2 Can we make safe one surely?

- If we comply with the RAMS standard that requires a lot of efforts, we can make safe one surely.

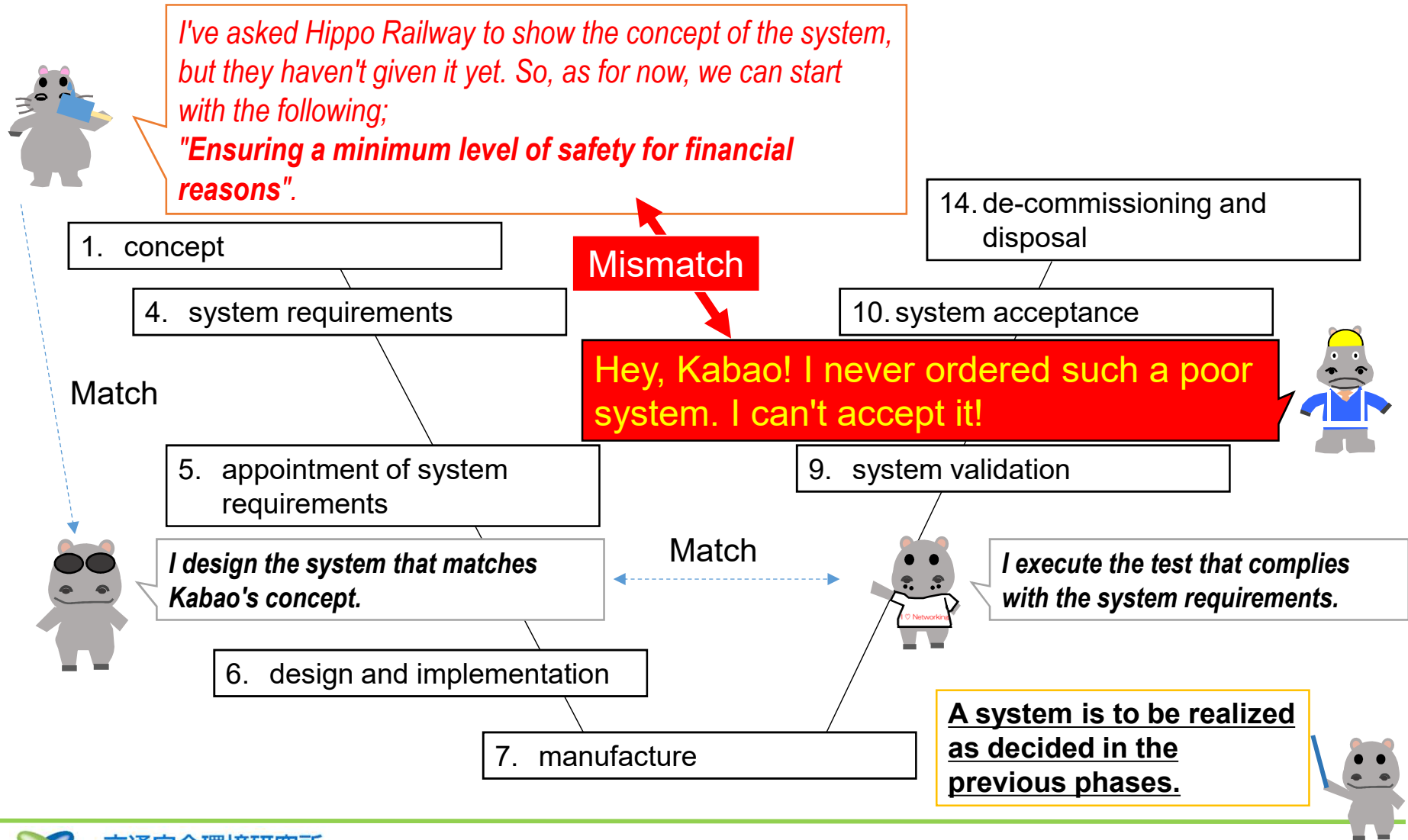
→ **No, it's NOT true.**

– *does not define RAMS targets, quantities, requirements or solutions for specific railway applications;  
(IEC 62278:2002,1.1)*

If we cannot make better one, it will be meaningless!



# 0-2-2 Why cannot we make safe one surely?



# 0-2-2 Must we do something unfamiliar?

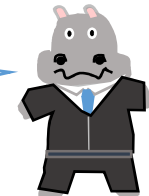
- Do we have to do something unfamiliar?

→ **No, you don't have to!**

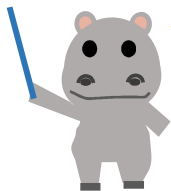
– *The approach defined in this standard is consistent with the application of quality management requirements contained within the ISO 9000 family of International Standards.  
(IEC 62278:2002 introduction)*



Then, isn't it enough to comply with the ISO 9001 standard?



For railway industries, more practical management application is shown in the RAMS standard than in the ISO 9001 standard. Your leadership for quality and safety management is required to utilize the standards more effectively.





# 0-2-3 To whom it is needed?

0-1 Why do standards exist?

0-2 Purpose of RAMS standard

0-2-1 What the standard aims for

0-2-2 What is often misunderstood

**0-2-3 To whom it is needed?**

0-2-4 What it can and what it cannot

0-3 Basic technology regularly used in the standard

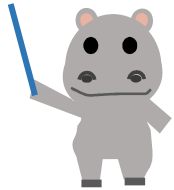
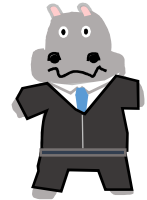
0-3-1 Verification and validation (V&V)

0-3-2 Traceability



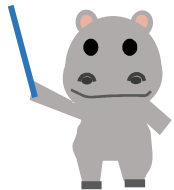
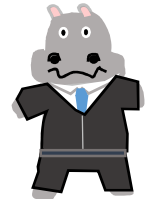
# 0-2-3 To whom it is needed?

Many attendees at various meetings I've attended always complained about the RAMS standard: "It's meaningless.", "They are the management system for Europe and not suitable for our country.", and "We have our own QC system."



Who attended those meetings? I suppose those were for skillful engineers or executive officers like you.

Yes, I saw many important executives.



Because these people are skillful, they have little reason to learn step by step. Someone who needs some hints may not be those people.

Management standards are supposed to be a program that guides us to achieve to some designated level. If we think so, we find that the standards are to help continuous operation of companies. The standards are not for skillful persons, but for newcomers.

# 0-2-4 What it can and what it cannot

0-1 Why do standards exist?

0-2 Purpose of RAMS standard

0-2-1 What the standard aims for

0-2-2 What is often misunderstood

0-2-3 To whom it is needed?

**0-2-4 What it can and what it cannot**

0-3 Basic technology regularly used in the standard

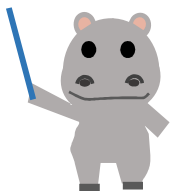
0-3-1 Verification and validation (V&V)

0-3-2 Traceability



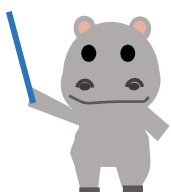
# 0-2-4 Scope of the RAMS standard

In the RAMS standard, like manuals, does it include the quality control or railway safety methods precisely and practically? If so, it must be very helpful.



As you say, it may be really helpful, but it is not that easy. For example, there is a difference in the assumed vibration and temperature between on board equipment and ground equipped system. Specific numerical goals or solutions, and safety requirements are not included, not to mention how to persuade the Hippo Railway.

Well, it's a little disappointing.



The RAMS standard does not determine specific numerical conditions, but determines the relationship between availability and safety in a well-balanced manner, which is often in conflict, and incorporates it into the specifications as a requirement. It is a standard that can be used as a reference for what must be done at what stage as the process progresses.

Great! It tells me when and how to give the right instructions to Kabao or hacking Hippo, isn't it? Timely directions! This is the mission of CEO.



# 0-2-4 Scope of the RAMS standard

- defines RAMS in terms of reliability, availability, maintainability and safety and their interaction;*
- defines a process, based on the system life cycle and tasks within it, for managing RAMS;*
- enables conflicts between RAMS elements to be controlled and managed effectively;*
- defines a systematic process for specifying requirements for RAMS and demonstrating that these requirements are achieved;*
- addresses railway specifics;*

IEC62278:2002 1.1

# 0-2-4 Out of the scope of the standard

- does not define RAMS targets, quantities, requirements or solutions for specific railway applications;*
- does not specify requirements for ensuring system security;*
- does not define rules or processes pertaining to the certification of railway products against the requirements of this standard;*
- does not define an approval process by the safety regulatory authority.*

*IEC62278:2002 1.1*

This standard shows processes of realizing safety, reliability and system requirements, but does not provide them directly.

# 0-3 Basic technology regularly used in the standard

0-1 Why do standards exist?

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0-2-4 What it can and what it cannot

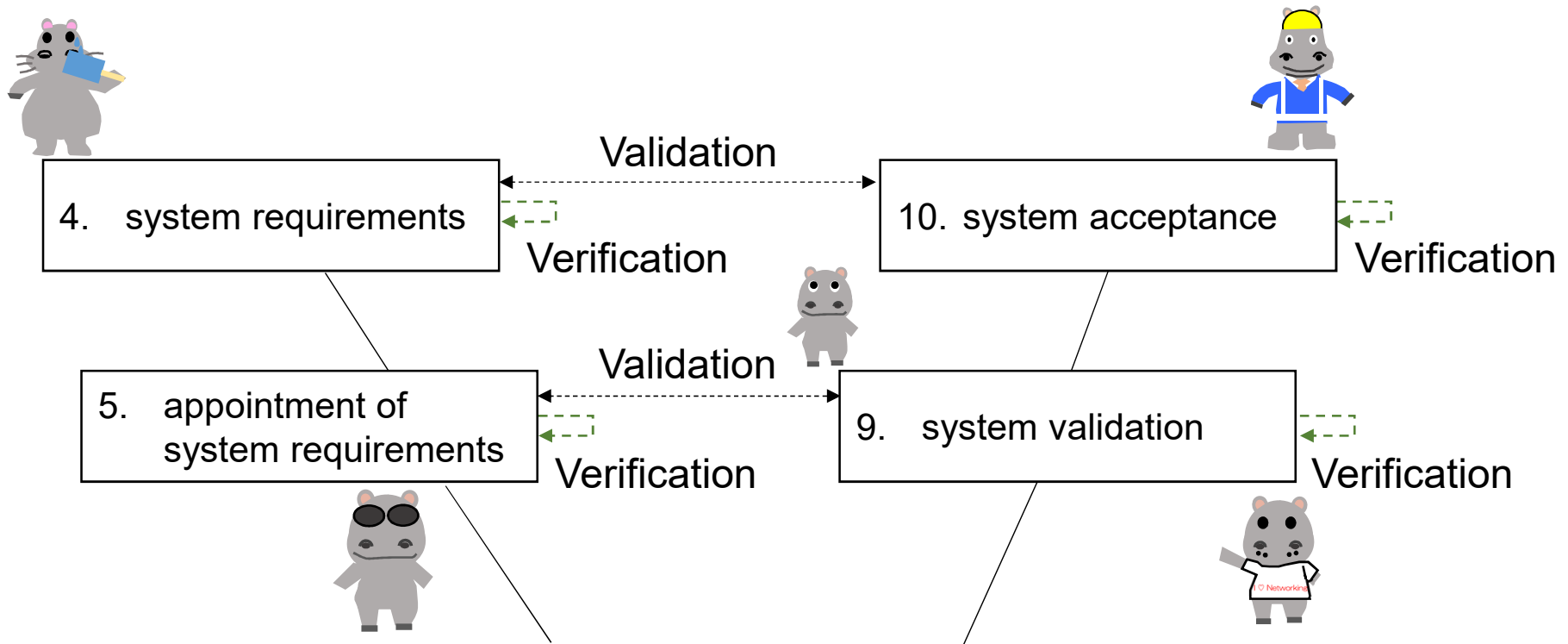
## **0-3 Basic technology regularly used in the standard**

**0-3-1 Verification and validation (V&V)**

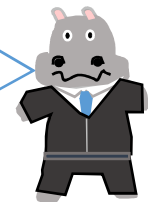
**0-3-2 Traceability**



# 0-3-1 V&V concept



I see many roles, but what's that?  
Verification and validation? They're really similar words.  
I think verification is to confirm the action in each phase, and validation is to confirm whether the result is as expected.

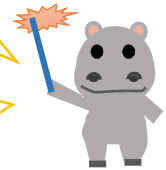




# 0-3-1 V&V concept

V&V stands for Verification and Validation, and this system life cycle model is called the V-model that represents graphically.

When one of your employee made a specification, you ask the other employee to check it, don't you?



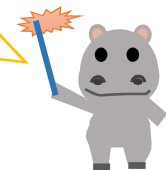
Yes, It is **important to be checked by another person**. Of course, checkers are also to confirm the feasibilities and quality of specifications.

This is a verification. **If someone finished a phase, others are to check it.**



Then, how about validation? If we check each phase precisely, I think we don't need an another method.

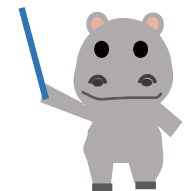
I understand what you mean, but sometimes a product is not realized as designed. Validation is a check process to see if a product is made according to the original idea.



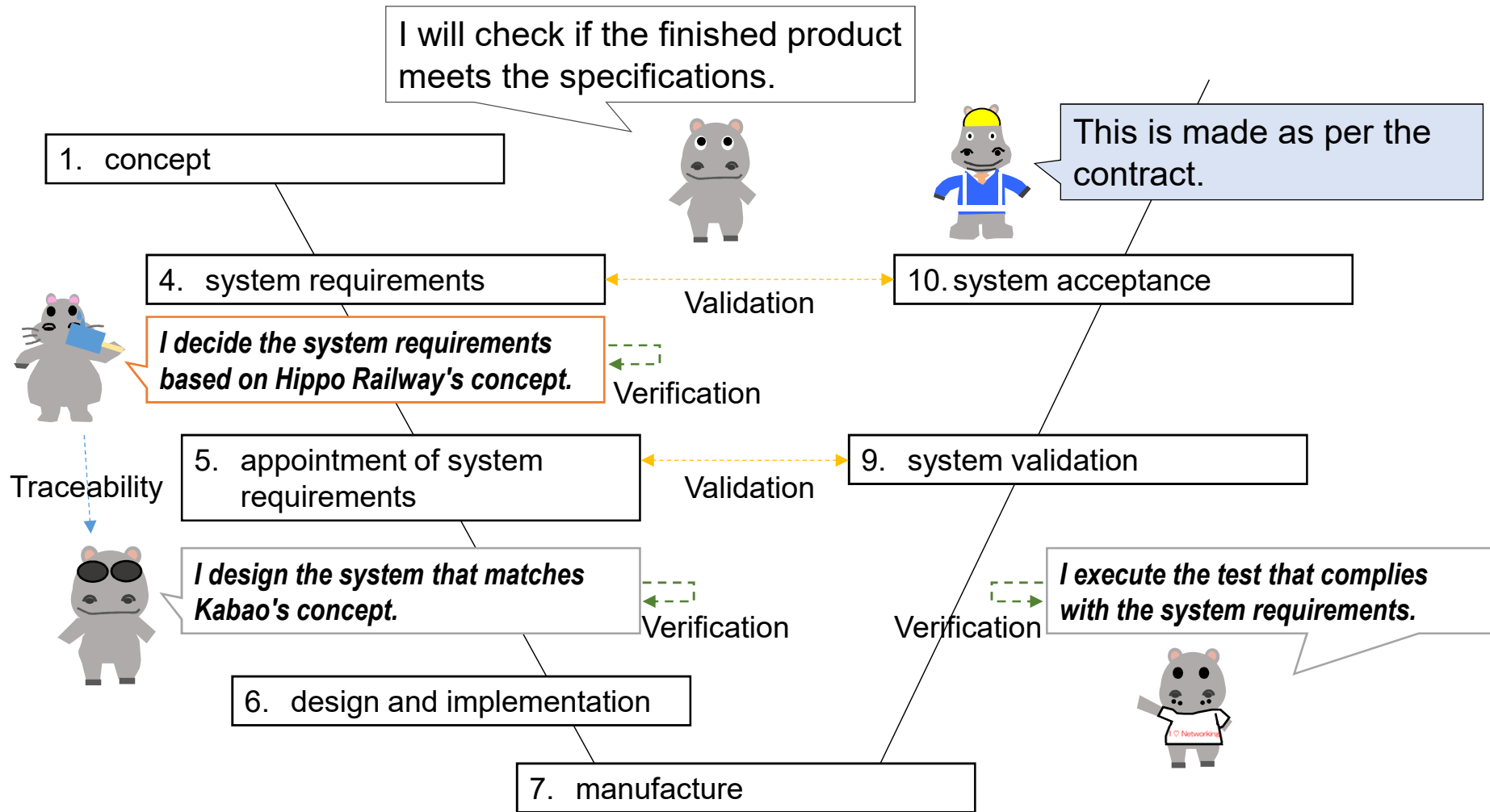
# 0-3-2 Traceability

In life cycle management, traceability is the evidence of consistency between phases, and a method to confirm the following;

What was decided in the upper phase must be reflected in the lower phase. So, it is strange that something suddenly appears in the lower phase or that the decision in the upper phase is ignored.

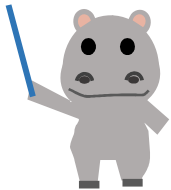
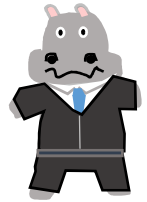


# 0-3-2 Relationship between V&V and traceability

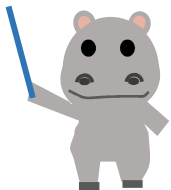


# 0-3 V&V and traceability

It was quite difficult to understand the terms I am not familiar with. Will you explain them using the words that I am familiar with.

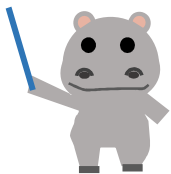
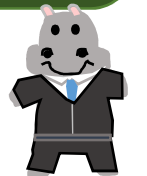


It may not be much different from what you have done so far in Hippo Corp.



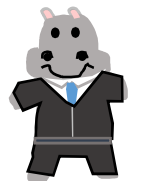
The system is designed, manufactured, and tested so that it does not conflict with the system requirements.  
When someone makes materials, other people check them.  
Test contents correspond to the system specifications.

Well, they are basic works that we usually perform.



In that case, the works that you always do shall be written down as a document.

You are great! We would like you to join our company. We can offer you an excellent salary.



# Conclusion

- 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 basic roles to follow are V&V and traceability.