

# FAQs on Dependability

for the DSN community to answer,  
if it is willing to help for a dependable society

Takashi Nanya

# System of hierarchical IT-based systems

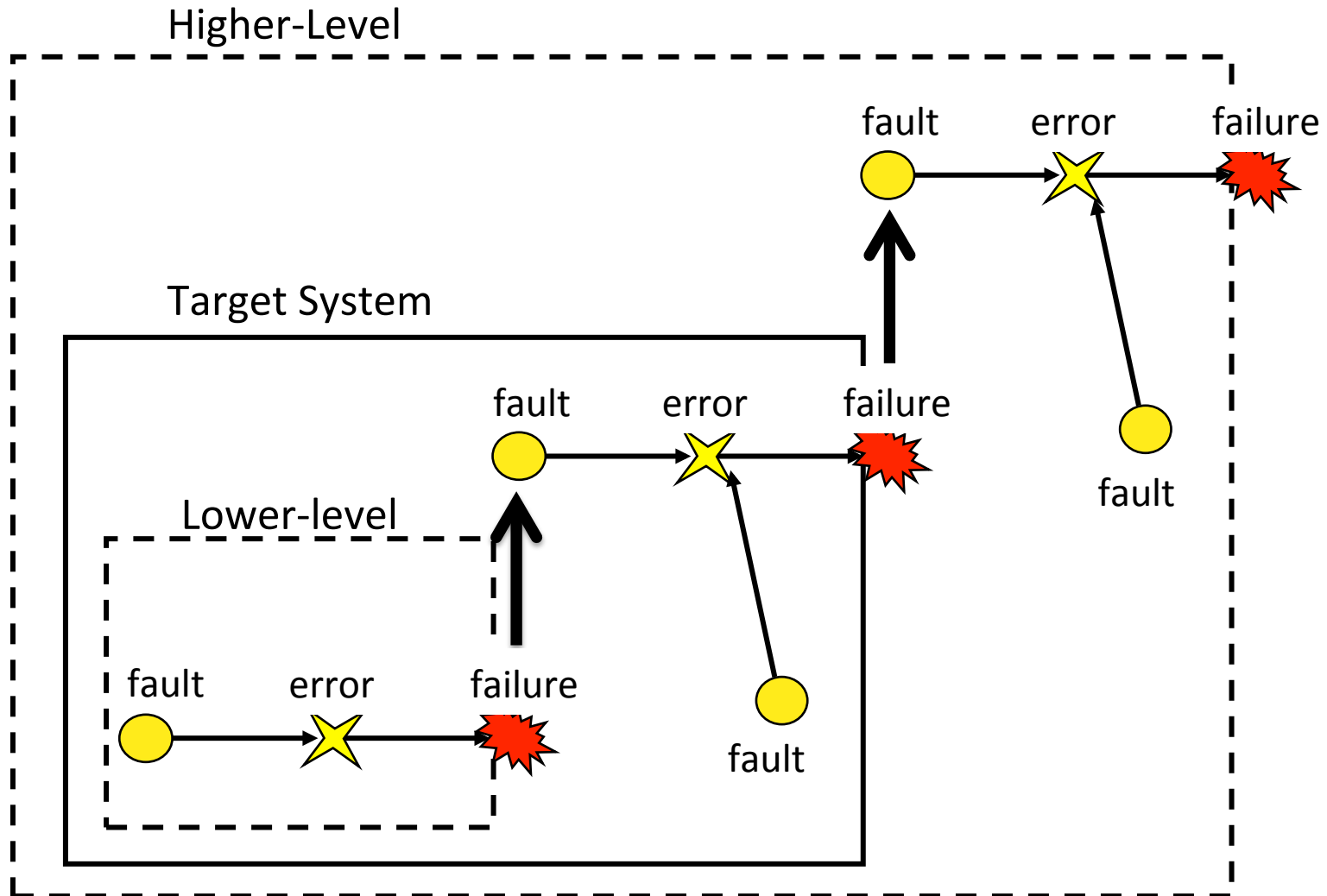
**Information Society**  
**(Humanity)**

**Solutions**  
**(Life, Health, Entertainment, Business, Finance)**

**Infrastructures**  
**(Big data, AI, Cloud, IoT, Block chain)**

**Computing & Communication**  
**(Information, Energy, Materials)**

# Higher-level dependability matters more, otherwise lower-level makes little sense!



# Does DSN cover dependability of society?

**Dependable**  
**Information Society**  
**(Humanity)**

**Dependable**  
**Solutions**  
**(Life, Health, Entertainment, Finance)**

**Yes, it should!**

**Dependable**  
**Structures**  
**(AI, Cloud, IoT, Block chain)**

**Dependable**  
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# Well known concepts

The **service** delivered by a **system** is its behavior as it is perceived by its user

A **failure** occurs when the delivered service deviates from **correct service**.

A service fails either because it does not comply with the **specification**, or because this specification did not adequately describe the correct service.

FAQs on

Dependability for Higher-level Layers

Economics of Dependability

(also presented at IFIP WG10.4 meeting in Visegrád, Hungary)

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**Q:** Is the **boundary** between a target system and its environment self-evident at a higher-level layer?

**A:** Yes theoretically, but not necessarily in practice. It depends on which level and what you look at.

The higher-level layer includes a huge variety of services which are interacting with each other and changing day by day.

We need a “bottom-up” approach to define system boundary so that dependability efforts work as well at a higher-level layer.

**Q:** What is a **correct service** at a higher level?

**A:** There is no simple answer.

It may be decided not only logically, but also ethically, economically or even politically.

There may be even no consensus on what should be a right service, or intended function, for some areas at solution layer.

For some cases, a **statistically correct** service may be a possibility

**Q:** Can users always decide whether the delivered services fail or not?

**A:** Not necessarily.

For some cases at the solution layer, a correct service is “making a right decision” which no one can know.

Such cases include:

robot adviser for fintech, self-driving car, computer games, genome editing, VR/AR for medical applications, etc.

**Q:** For example, what is a **correct service** of Google's AlphaGO?

**A:** An ultimate correct service may be “defeating the opponent”. Then, when it loses, should it be called a service failure?

A refined correct service can be a “right choice of placing a stone on the board for each turn”. But whether right or not remains unclear until the game is over even for the world champion , as was actually the case.

**Q:** Can a system be made dependable with **correct services** undefined?

**A:** No, it cannot, by definition.

Correct services must be defined in order to decide whether the system fails or not.

Correct services can be defined If a given higher-level solution are refined into domain-dependent and problem-specific solutions.

We need a further study on this issue.

**Q:** Are there any faults unique to a higher-level layer?

**A:** It looks not. The well known classification of faults in computing systems also applies to higher-level layers, except physical faults which concern only hardware.

We need a further refinement in modeling human-made faults and interaction faults that can exist in both development phase and operation phase, either accidentally or deliberately.

**Q:** What makes the existing dependability efforts difficult at a higher-level layer?

**A:** The recent increase in system complexity and interdependency is overwhelming, while human capability remains unchanged.

This **gap** can be a major source of threats to the dependability for the information society, and it's still increasing.

We need a further study on how to manage it.

**Q:** Should the DSN still cover the solution layer?

**A:** Yes definitely.

We need dependability for the information society where we live anyway.

We should provide the society with a mean that can tell the faults at the solution layer from the failures at a lower layer, so that the higher-level dependability is appropriately designed and assessed.

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## Engineers' question

**Q:** I know existing dependability efforts. What I don't know is how much more dependability is achieved by their deployment from user's point of view.

**A:** Unfortunately, the quantitatively evaluated effect of dependability efforts on system dependability is not well known or developed.

## Project Managers' questions

**Q:** We definitely need dependability. What should we do to achieve high dependability within a given budget and delivery time ?

**A:** Hard to answer.

Dependability engineering is not matured at all, and needs to develop furthermore.

## CTO/CIOs' question

**Q:** I know we need dependability. How much should we invest in it? How much return can we get ?

**A:** Again, hard to answer. Economics of dependability has not been developed at all, and needs extensive studies.

## Customers' question

**Q:** Dependability is my first priority. How can I tell the high dependability from the low in advance? How much more should I pay for it?

**A:** We don't know. No convincing way exists to tell the high dependability from the low dependability in advance, and therefore, no way for pricing.

# Where we are

- A long history of research on dependability efforts
- Little work on how much effect each effort has on system dependability.
- A long history of research on dependability evaluation
- Little work on mapping of dependability measures to economic value.
- Thus, lack of dependability economics

# What we need

## Quantifying relations between:

### Dependability Efforts

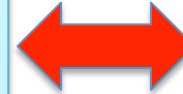
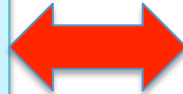
Fault prevention  
Fault tolerance  
Fault removal  
Fault forecasting  
Failure response

### Dependability Measures

Reliability  
Availability  
Integrity  
Safety  
Maintainability  
Confidentiality

### Economic value

¥, \$  
€, £



# Conclusions

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