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Six Common Mistakes Engineers Make When Dealing with Availability

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What is Availability?

- **Availability is the statistical probability that a system will be ready for your use when you want to use it**
- **Often confused with a different but related statistical topic – reliability**
- **Availability is important because**
  - Users build expectations about the system around it
  - Engineers design to it
  - The cost of the system is driven by it
  - Operations people get paid by it

Design for High Availability is Risk Mitigation

- There is always a risk that some components in a system will fail
- Specifying that a system will have a high availability transfers that risk from the owner of the system to the designer
- The designer must take steps to mitigate that risk, and will charge the user for everything he does
- The more the risk is reduced, the more is costs the owner
- The progression is not necessarily linear

Common Mistakes

- **Problems arise when the customer does not understand**
  - What availability means
  - How the system is architected
- **Communication can help avoid these common pitfalls**
- **Six Common Mistakes**
  - Expressing availability as time
  - Treating availability as a single dimension
  - Failing to limit the scope of availability
  - Failing to identify partial availability
  - Failing to account for preventative maintenance
  - Measuring performance short term

Mistake #1 – Expressing Availability as Time

- This is a common chart shown for availability
- Unfortunately it is wrong, and conveys inappropriate expectations

Availability	Unavailability (Minutes/Year)
99.9%	525.6
99.99%	52.56
99.999%	5.256
99.9999%	0.5256
99.99999%	0.05256

- Availability is not time, it is a probability

A Better Slide

Availability	Unavailability
99.9%	0.1%
99.99%	0.01%
99.999%	0.001%
99.9999%	0.0001%
99.99999%	0.00001%

- **This chart introduces no erroneous information**
- **Often the unavailability of a system is what we really want to know - outage**

Mistake #2 – Treating Availability as a one Dimensional Point

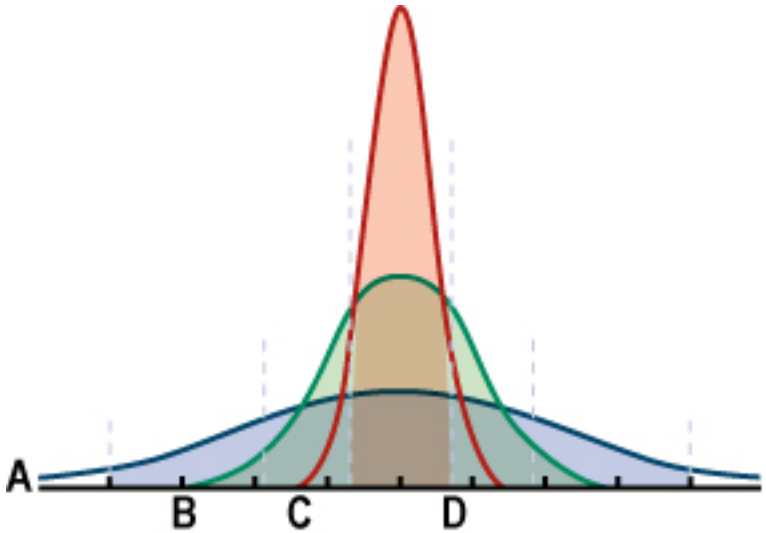
- **Albert Einstein is quoted as having said**
  - "Everything should be as simple as possible, but no simpler."
- **Why?**
  - As a university professor, I always strove to make things as simple as possible, in order to communicate understanding of them
  - **But when you make things simpler than they are, you lose essential information.**
    - **Design a box for me**
    - **The height is 2 feet**
    - **The depth is 1 foot**
    - **Go**
- This is what we do with Availability all the time
- Availability is not one dimensional, its two dimensional

Another Look at the Misleading Chart

Availability	Unavailability (Minutes/Year)
99.9%	525.6
99.99%	52.56
99.999%	5.256
99.9999%	0.5256
99.99999%	0.05256

- **Is a 5-9's system always down for 5.256 minutes each year?**
- **When in the year? At the beginning? At the end?**

Availability is a Probability, and Probabilities have Distributions



- All four systems described by curves A,B,C, and D have the same statistical mean
- Yet they describe systems that behave differently

Consider a System with 50% Availability

- **Sometimes to understand something you have to take it to a ridiculous extreme**
- **Lets consider a system with 50% availability**
- **All of the following systems have 50% availability**
  - One year on – One year off
  - Six months on – Six months off
  - One day on – One day off
  - One minute on – One minute off

Mistake #3 – Measuring Actual Performance in a Short Time Horizon

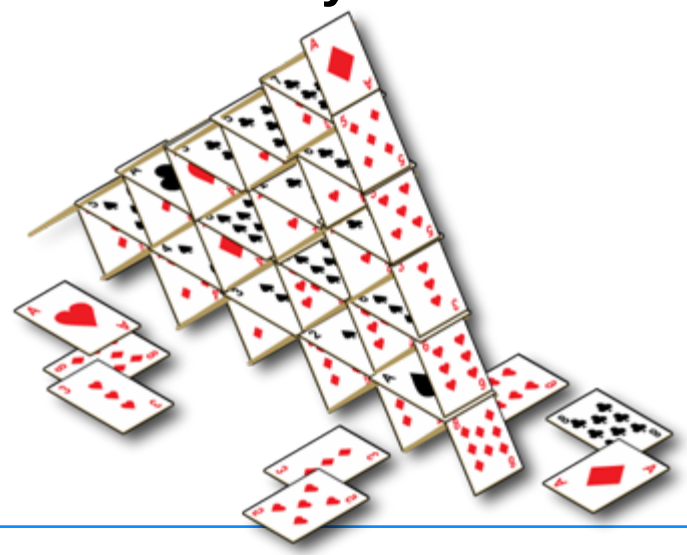
- **Statistical probabilities are meant to represent behavior across long time horizons such as 30 years**
- **A mistake is made when compensation is based on short term measurements**
- **Consider the 50% availability system and a six month measuring period**
  - If the system is in a mode of 1 year up and 1 year down, you will believe that the system is 100% available
  - If the system is 1 year down and 1 year up, you will believe the system has 0% availability
  - If the system is 1 day up and 1 day down, you will believe that the system is 50% available

How Should Performance be Measured?

- **The Availability formula is composed of Mean Time Between Failure (MTBF) and Mean Time To Repair (MTTR)**
- **Both MTBF and MTTR are distributions**
- **When you do the calculation by hand you are using the mean of each distribution**
- **Predicted availability should be described with a system model and then simulated**

$$\text{Availability (A)} = \text{MTBF}/(\text{MTBF} + \text{MTTR})$$

$$\text{Unavailability (U)} = \frac{\text{MTTR}}{\text{MTBF}}$$



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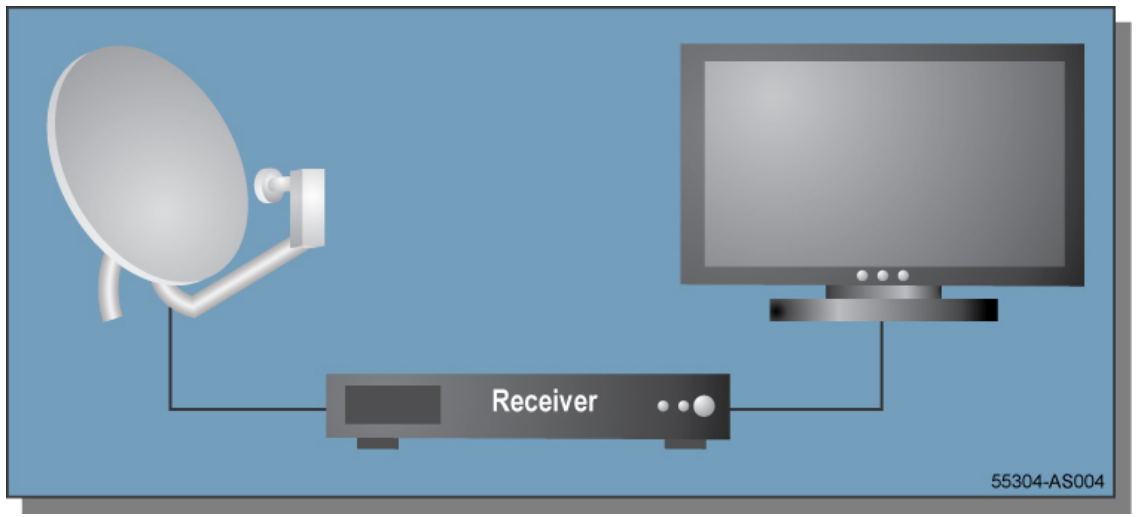
Mistake #4 – Failing to Limit the Scope of Availability

- **Always ensure that the scope of availability is within your scope of control**



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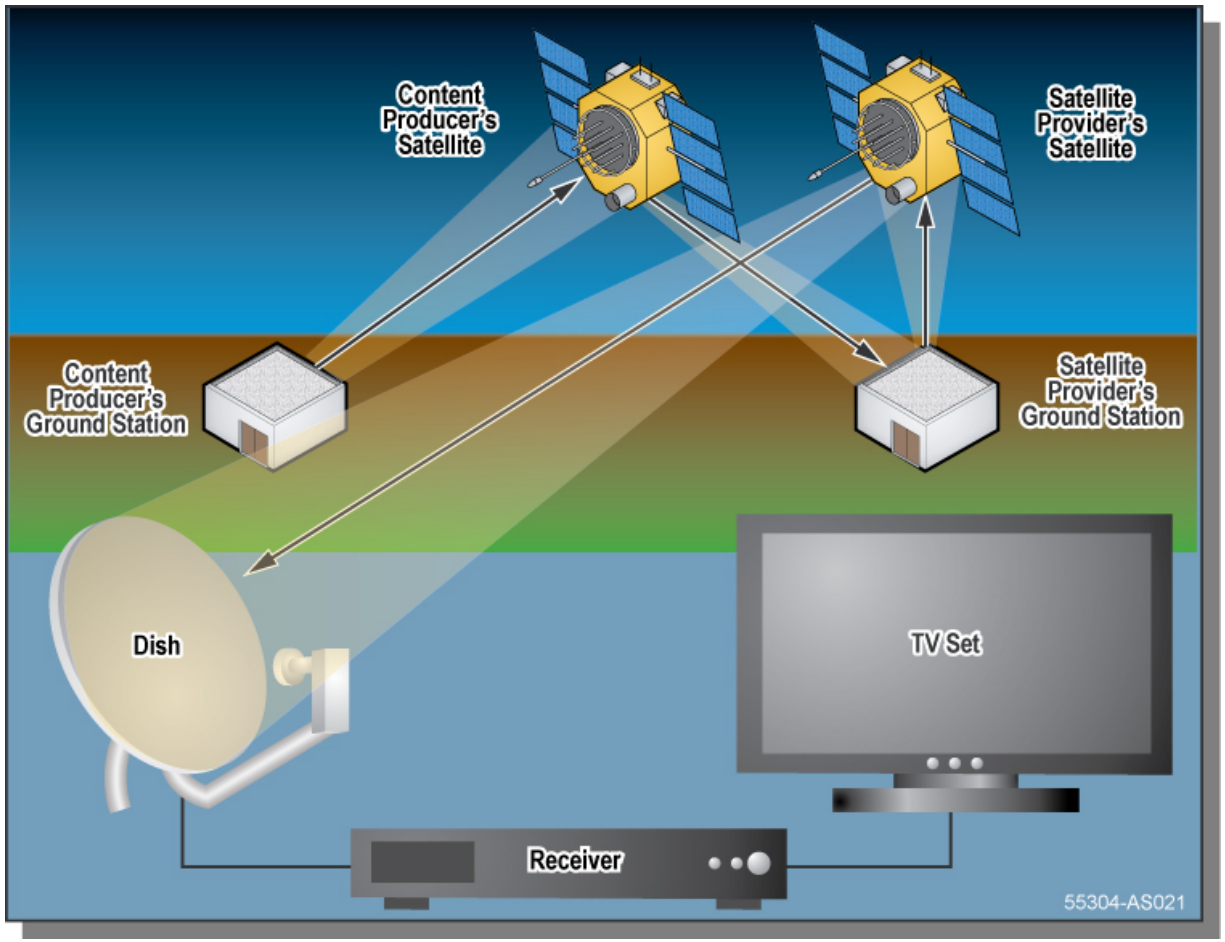
The Bigger Picture



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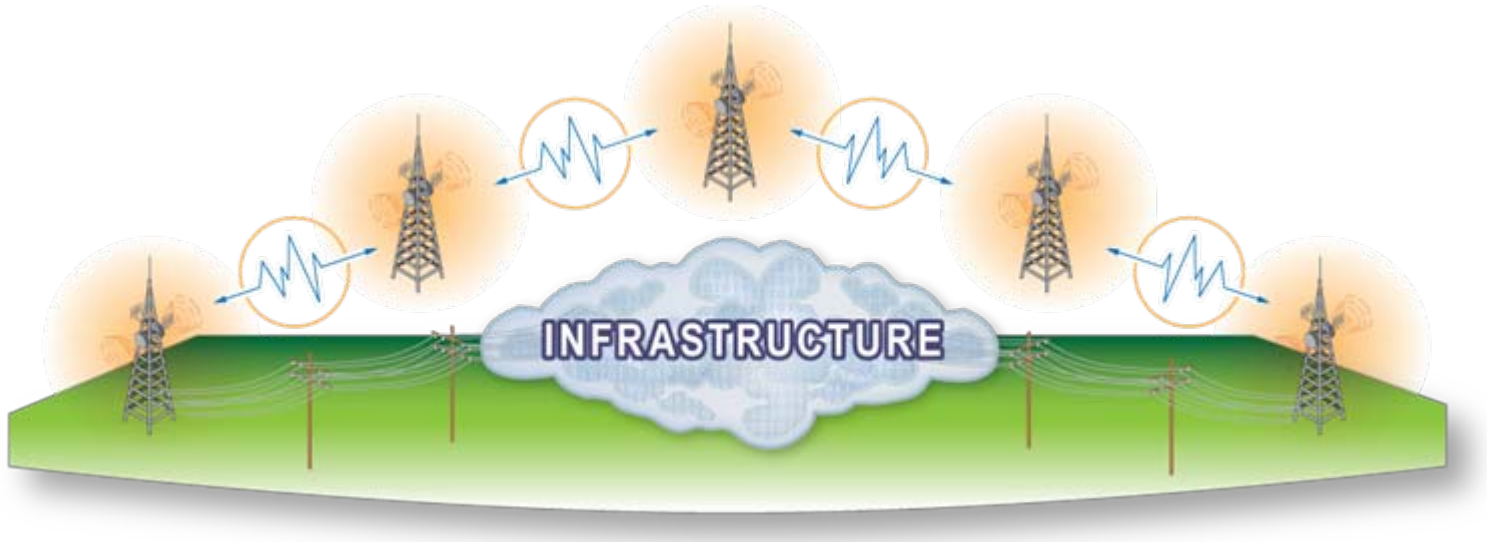
Mistake #5 – Failing to Identify Opportunities for “Partial Availability”

- Modern systems are extremely complex and often spread out over large geographical areas
- Availability should be expressed on a sub-system or geographical basis where applicable
- View this as a learning experience for your customer



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Mistake #6 – Failing to Account for Preventative Maintenance

- You and your customer need to decide if preventative maintenance is inside or outside the scope of the availability calculations
- It drives radically different designs
- I advocate for full communication with the customer

Summary

- **Problems arise when the customer does not understand**
  - What availability means
  - How the system is architected
- **Communication can help avoid these common pitfalls**
- **Six Common Mistakes**
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Thank You

Contact

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