



HACoC-Europe

# High Availability Center of Competency: HA & DR Concepts and Approach

**Christine O'Sullivan**  
IBM Certified IT Specialist  
HACoC-E Leader

## Agenda



- HACoC Team
  - Missions
  - HA Assessment Process
- Availability Concepts and Approach
- Disaster Recovery Solution : Implementation experience

## High Availability Center of Competency (HACoC) Missions

The STG High Availability Center of Competency (HACoC) works with client to define the steps to improve availability of their *end-to-end IT infrastructure*.

- **The HACoC engages with clients for a high-level review the architecture and IT service management of current implementations or proposed deployments in order to identify:**
  - *High priority focus areas*
  - *Next steps for client and IBM*
- **The HACoC is center for information on I/T availability**
  - *Best Practices*
  - *Reference Architectures*
  - *Collateral*
  - *Web Site*
- **The HACoC Provides feedback to IBM Labs based on engagements to identify product gaps, test opportunities and solution opportunities.**

# HACoC: A Worldwide Team working with clients to define tactical and strategic steps to improve Availability

*Consistent HACoC engagement methodology between HACoC Centers*

- HACoC-WW Team located in the US : 17 people

- HACoC-E Team located in MOP: 5 people

- HACoC Team Leader: **Christine O'Sullivan**
- HA Engagement Leader (System z): **Jocelyn Denis**
- HA Engagement Leader (System p): **Eric Wong**
- Availability Management Specialist : **Christian Monvoisin**
- Project Manager: **Marc Bouzigues**

- HACoC-AP Team located in Japan: 4 people

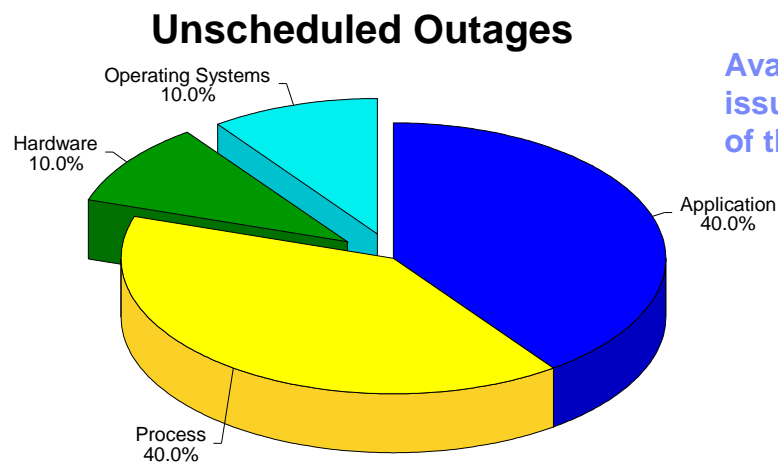
## SMEs

- Local country team
- STG / PSSC
- Lab Services
- GTS
- ATS



## Industry Standard Definitions

- **Continuous Availability (CA)**- Attribute of a system to deliver non disruptive service to the end user 7 days a week, 24 hours a day (there are **no planned or unplanned outages**).
- **Continuous Operations (CO)**- Attribute of a system to continuously operate and mask **planned outages** from end-users. It employs Non-disruptive hardware and software changes, non-disruptive configuration, software coexistence .
- **High Availability (HA)**- The attribute of a system to provide service during defined periods, at acceptable or agreed upon levels and masks **unplanned outages** from end-users. It employs Fault Tolerance; Automated Failure Detection, Recovery, Bypass Reconfiguration, Testing, Problem and Change Management
- **Disaster Recovery (D/R)** - Protection against **unplanned outages such as site disasters** through reliable, predictable recovery, usually on different hardware.



Availability typically is thought of as a technology reliability issue; in reality, application and process issues make up 80% of the total outages.



Source: Gartner Group

# Sample Input: IT Service Management Definitions (ITIL view)

ITIL is a process base method and is discussed during the HACoC Workshop

## ■ IT Service Support

- **Service Desk** - Central point of contact between IT and users. Record and life cycle management of all Service Requests, keeping the customer informed of progress and advising on workarounds.
- **Incident Management** - Restore service ASAP after an interruption or reduction in service
- **Problem Management** - Determine root cause and proactively minimize the impact to the business of incidents and problems caused by errors within the IT Infrastructure.
- **Change Management** - Control and manage changes in the IT environment with the smallest possible risk to the agreed service levels.
- **Release Management** - Plan, design, build, configure and test hardware and software to create a set of Release components for a live environment.

## ■ IT Service Delivery

- **Availability Management** - Guarantee the availability of IT services, agreed upon by clients, by adequate deployment of means, methods and techniques for such attributes as reliability, maintainability, serviceability and resilience
- **Service Level Management** - Negotiate, define, contract, monitor and review the levels of customer service, that are both required and cost effective.
- **Capacity Management** - Match capacity and demand by increasing or managing available capacity. Ensure the optimum use of IT resources to achieve agreed upon performance.
- **IT Service Continuity Management** - Plan for and restore service after a disaster

*The ITIL (Information Technology Infrastructure Library) is a framework of best practices to manage IT operation and services. It defines IT processes including many that are critical to continuous availability*

# HACoC Internet Website <http://www-03.ibm.com/systems/services/highavailabilitycenter/>

Address <http://www-03.ibm.com/systems/services/highavailabilitycenter/>

Links [IBM Business Transformation Homepage](#) [IBM Standard Software](#)


**(HACoC @us.ibm.com)**

**IBM**

Home Products Services & industry solutions Support & downloads My IBM


IBM Systems-related services >

## IBM High Availability Center of Competency



**Who we are**  
IBM High Availability Center of Competency (HACoC) is dedicated to helping clients design and deploy the highly available, end-to-end IT infrastructures needed to make On Demand Business possible.

**Our value to you**  
IBM HACoC draws from technology and systems management expertise across IBM and the industry. We work with clients to identify opportunities that can help improve the availability and resiliency of their end-to-end IT infrastructure.



**What we offer**  
The HACoC can help to:

- Provide clients high-availability analysis and design engagements
- Serve as the single point of contact for high-availability resources within IBM
- Serve as a single point of reference for cross-platform high-

**IBM Systems-related services**

- Executive Briefing Centers
- Design Centers
- High Availability Center of Competency
  - Approach
  - Benefits
  - Library
- Benchmark Centers
- Deep Computing Capacity on Demand
- Locations

**Related links**

- Support for IBM Systems
- Technical support advantage
- Autonomic computing
- Solution Connection search
- IBM Systems education
- IT infrastructure solutions

**We're here to help**

Want to work with the High Availability Center of Competency? We're here to help.

☐ Contact the HACoC

**Event**

IBM Systems and Technology Group Presents the Business Continuity Series

→ Learn more

Download PDF (183KB)

**Additional Information**

- IBM Global Services business continuity and recovery
- IBM Systems Storage business continuity
- Availability for the Parallel Sysplex
- System i5 and iSeries High Availability
- System p servers: High availability

# Standard Client engagements

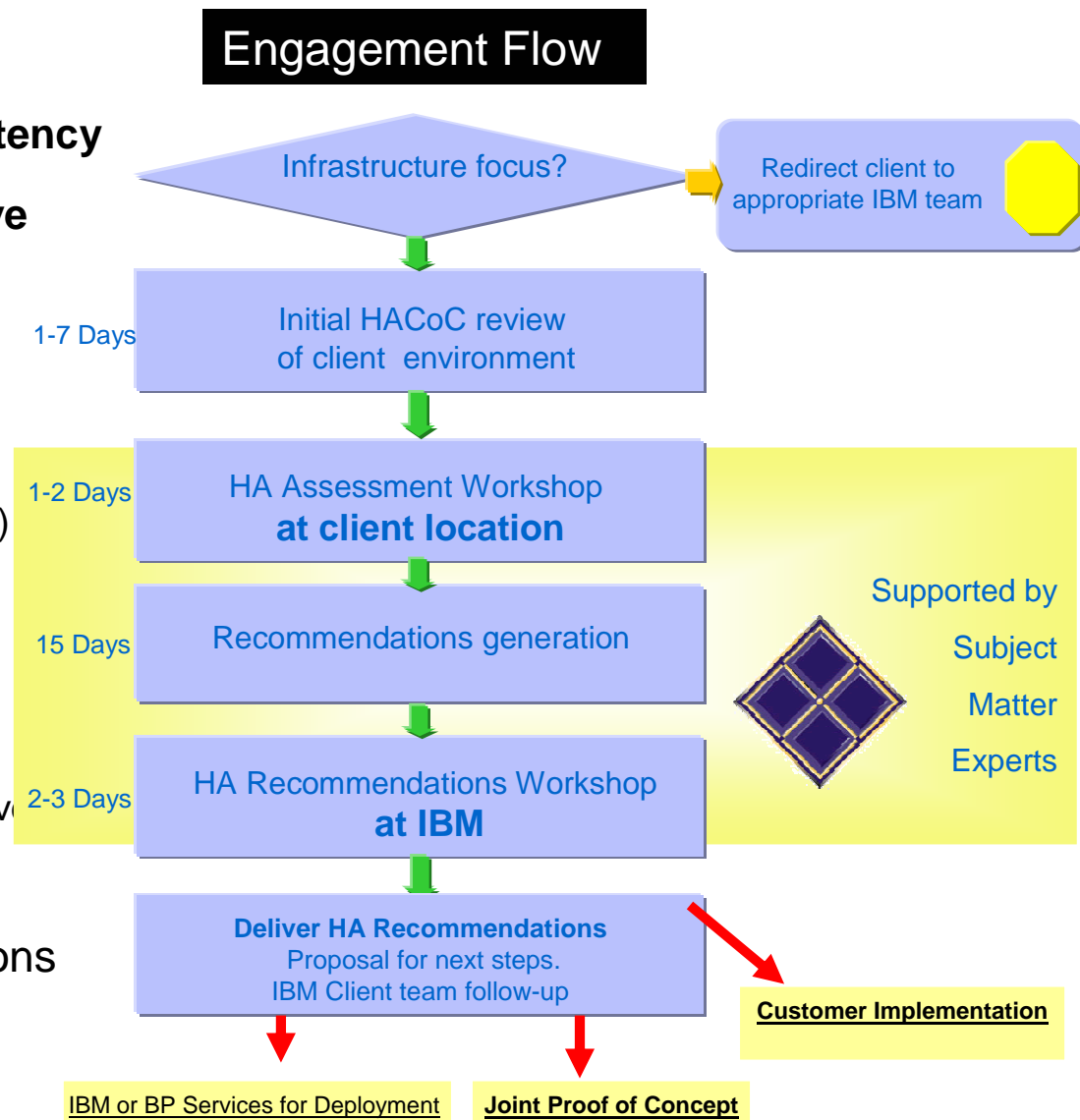
■ **Scope**  
**The High Availability Center of Competency (HACoC) works with clients to define tactical and strategic steps to improve availability of their *end-to-end IT infrastructure*.**

- **Analyze**
- Technology exploitation (SPOF/Recovery procedure /DR ...)
  - How techno is managed (Processes Analysis, maintenances/Changes, Skills...)

- **Technique**
- Infrastructure Review, Outage Analysis

- **Data Needs**
- Review Measurements (objectives ...)
  - Understand strategy (business/services level objectives/DR ...)
  - Understand IT infrastructure profile ...

- **Deliverable - Output: Recommendations**





## XYZ Workshop Agenda- Day One

- |  |                      |
|--|----------------------|
| ▪ XYZ Kickoff (project priority)                     | Client Sponsor       |
| ▪ HACoC & XYZ Introductions                          | EL                   |
| ▪ Engagement Overview                                | EL                   |
| ▪ XYZ Organization & Support Structure               | Customer             |
| ▪ Business Impact and Availability Objectives        | Customer             |
| ▪ Application Introduction and Transactions Overview | EL + Customer + SMEs |
| ▪ System p Infrastructure Deployment .               | EL + SME             |
| – System p and Storage Configuration                 |                      |
| – HACMP ...  |                      |
| ▪ IBM Team Review                                    | IBM                  |

## XYZ Workshop Agenda- Day 2

- |   |                     |
|---|---------------------|
| ▪ Review DAY 1  |                     |
| ▪ Maintenance of Key HW and SW                              | EL& SMEs & Customer |
| ▪ Discuss Potential Failure Scenarios / outage Analysis     | AVM & Customer      |
| ▪ Availability Management 1 (SLM, Configuration, Incident)  | AVM & Customer      |
| ▪ Availability Management 2 (Problem, Change, Availability) | AVM & Customer      |
| ▪ Summary and Wrap-up                                       | AVM                 |

## Deliverable


- The report will provide high level technology and Availability Management recommendations.
- Each technology recommendation will provide a detailed description of:
  - The issue being addressed
  - How to approach implementation
  - The benefit of implementing
  - The priority based on value and effort
- The Availability Management process recommendations may also include:
  - Organizational considerations
  - Data or information requirements
- Roadmap for Improving System p Availability at XYZ
  - List of recommended actions
    - Process
    - Technology
  - Time frame and logical order of implementation.

*The deliverable will be a presentation style report in PowerPoint format providing architectural and strategic recommendations for improvement.*

### Example Table of Contents

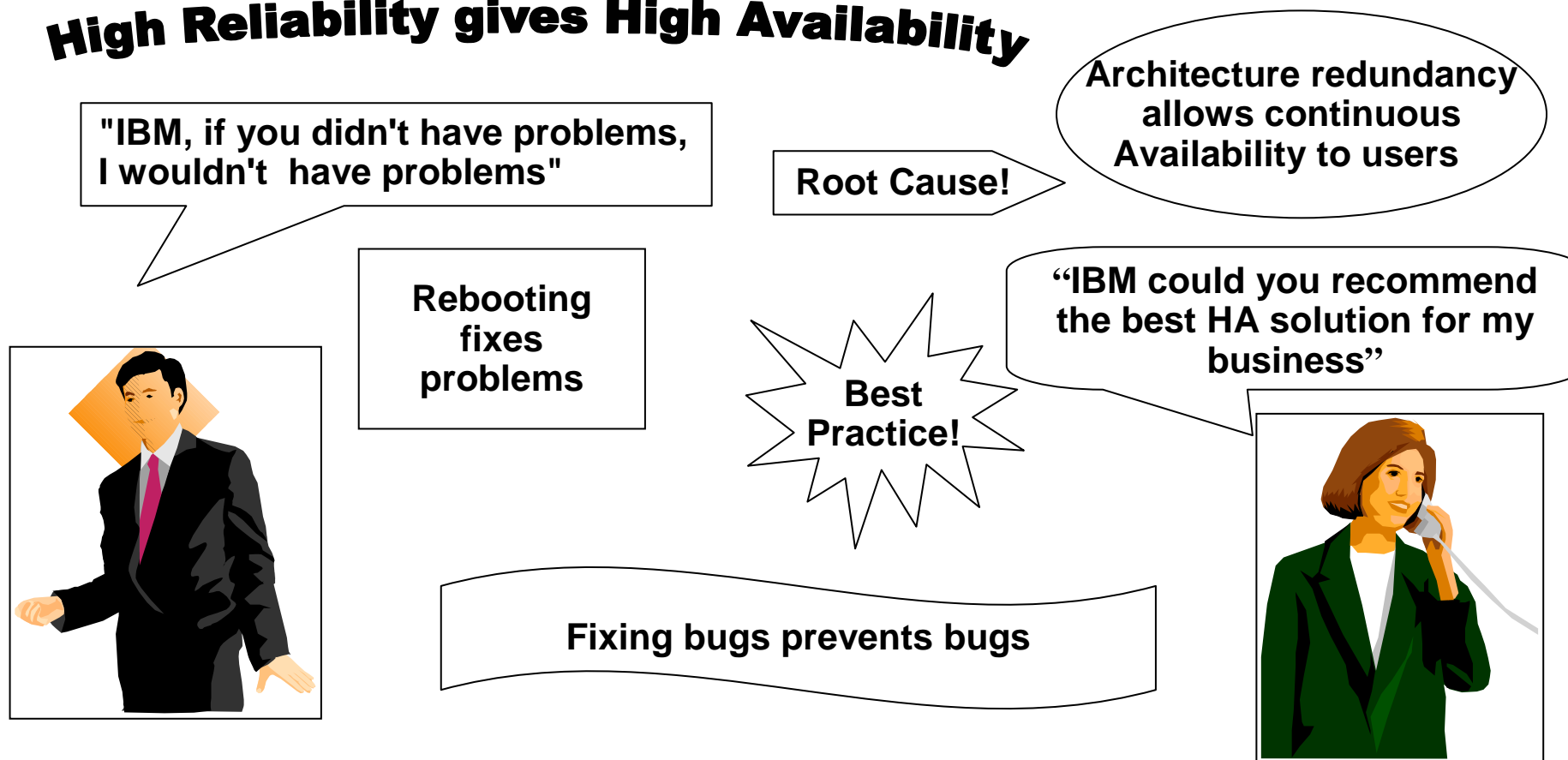
- Executive Overview
  - Customer Background
  - Objectives and Approach
  - General Observations
  - Key Recommendations
- Technology Recommendations
  - System p / AIX
  - Storage
  - Oracle
  - Websphere
- Process Recommendations
  - Service Level Management
  - Design and Test
  - Incident Management
  - Problem Management
  - Change Management
- Prioritized Action Item List and Roadmap
- Closing Summary and Next Steps
- Appendix (if applicable)

## Agenda

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  - HA Assessment Process
-  ■ Availability Concepts and Approach
- Disaster Recovery Solution : Implementation experience

This presentation describes the **HACoC vision** and approach **about IT Availability**, focusing on reducing importance of **myths related to availability expectations and achievement**

## High Reliability gives High Availability



**Component availability gives me service availability**

# Planning For Availability

- **Concentrate on the most important business systems/applications**
- **Define and document availability requirements**
  - Service level agreements (availability and response time)
  - Outage impacts/costs
  - Operational dependencies
- **Determine and analyze the infrastructure to find exposures**
  - Outage analysis for each key component/component group
  - Identification of single points of failure
- **Identify availability design alternatives based on the improvement techniques**
  - Will it reduce outage frequency, length, scope?
  - Will it eliminate certain types of outages from occurring?
- **Define and Implement Effective IT Management Processes**
  - Will contribute to higher levels of availability at a relatively low incremental cost.
- **Evaluate the alternatives relative to the requirements**
  - Cost or risk vs. benefit value
  - Timeliness (how quickly can it be done)
  - Additional hardware and/or software
  - New/changed organizational roles and/or skills

# What is high availability?

## ▪ What does HA mean to you?

- Five-9s
- Four-9s
- Three-9s

## ▪ Where do we measure it?

- At the system
- At the application
- At the user

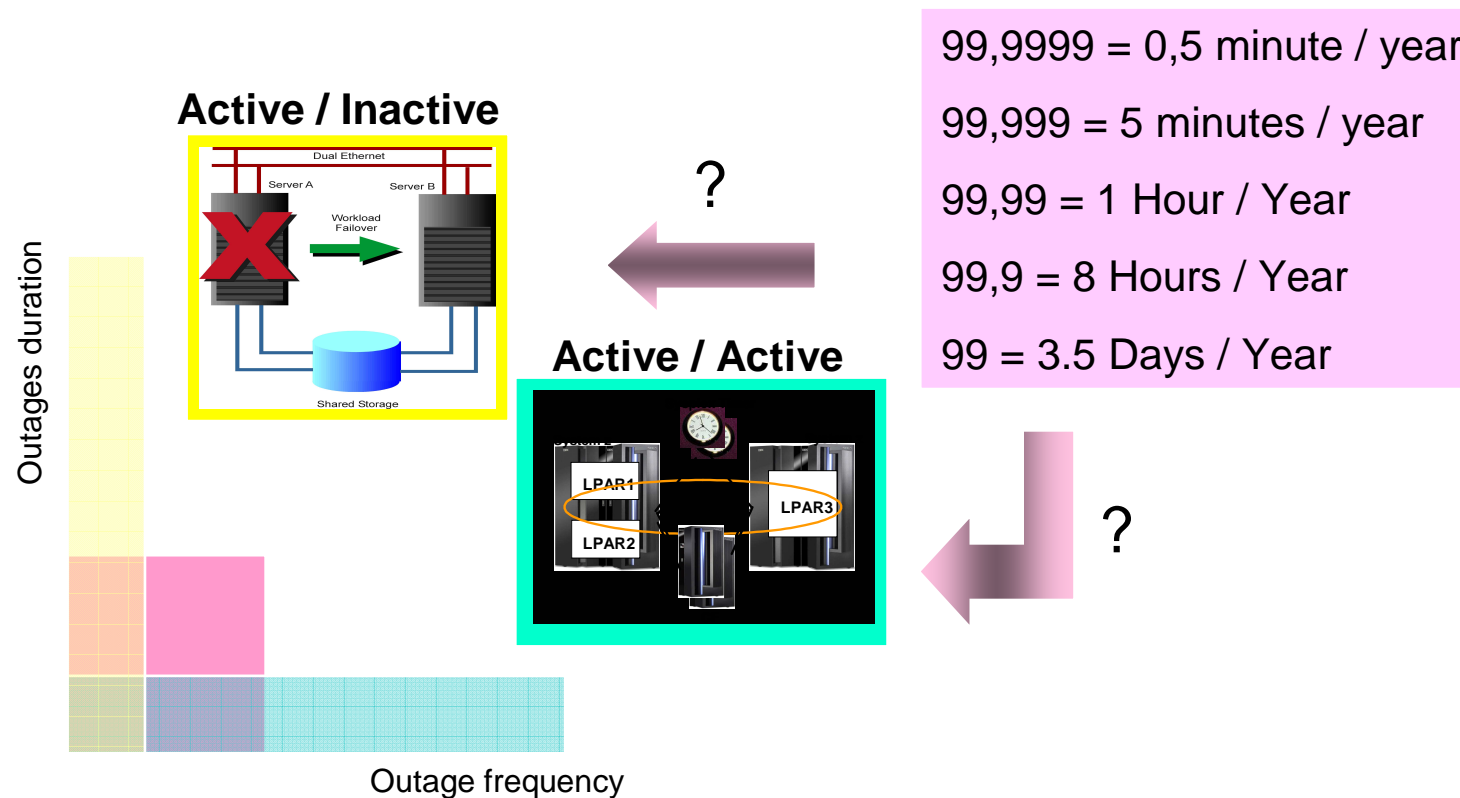
## ▪ What's required to deliver HA?

- Technology
- Skills
- Information
- Processes

Number of Nines	Availability (%)	Cumulative Outage per Year
6	99.9999	32 seconds
5	99.999	5 minutes
4	99.99	53 minutes
3	99.9	8.8 hours
2	99	3.6 days

*The chosen availability strategy will influence the design of the solution (Few outages / good reliability & fault tolerance, short outages / fast recovery)*

HA IT architecture **Consistency** cannot be assessed only thru the expected number of '9'. Its **Efficiency & Effectiveness** cannot be evaluated out of the business & IT environment.



HA architecture should also consider planned outages (maintenance)

# Unavailability is a Real Expense

- **Business Revenue**
  - Can also be lost “revenue opportunities”
  - Based on transaction business value
- **Productivity**
  - Application/Business system users (idle and recovery time)
  - Support personnel/systems (resolving unavailability situations)
  - Based on personnel cost of those impacted
- **Brand**
  - Negative publicity
  - Lost customers
  - Supplier relationships
- **Legal**
  - Contractual obligations (and associated penalties)
  - Late fees ...

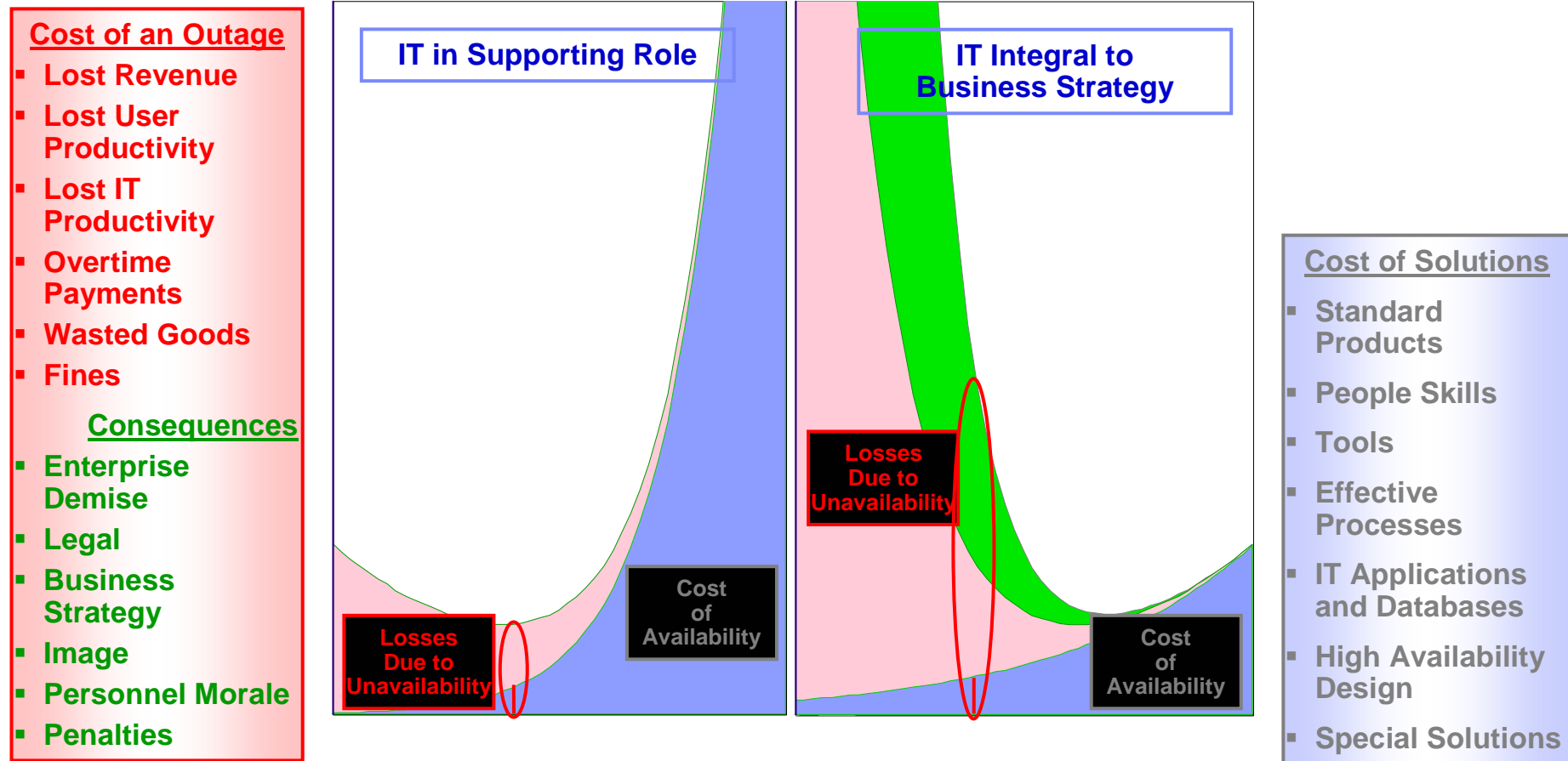
Business Operation	Downtime (Avg. Cost per Hour)
Brokerage operations	\$6.5 million
Credit card/sales auth.	\$2.6 million
PPV television	\$150 thousand
Home shopping (TV)	\$113 thousand
Catalog sales	\$90 thousand
Airline reservations	\$89.5 thousand

Source: META, February 2004





# IT impact on the Business

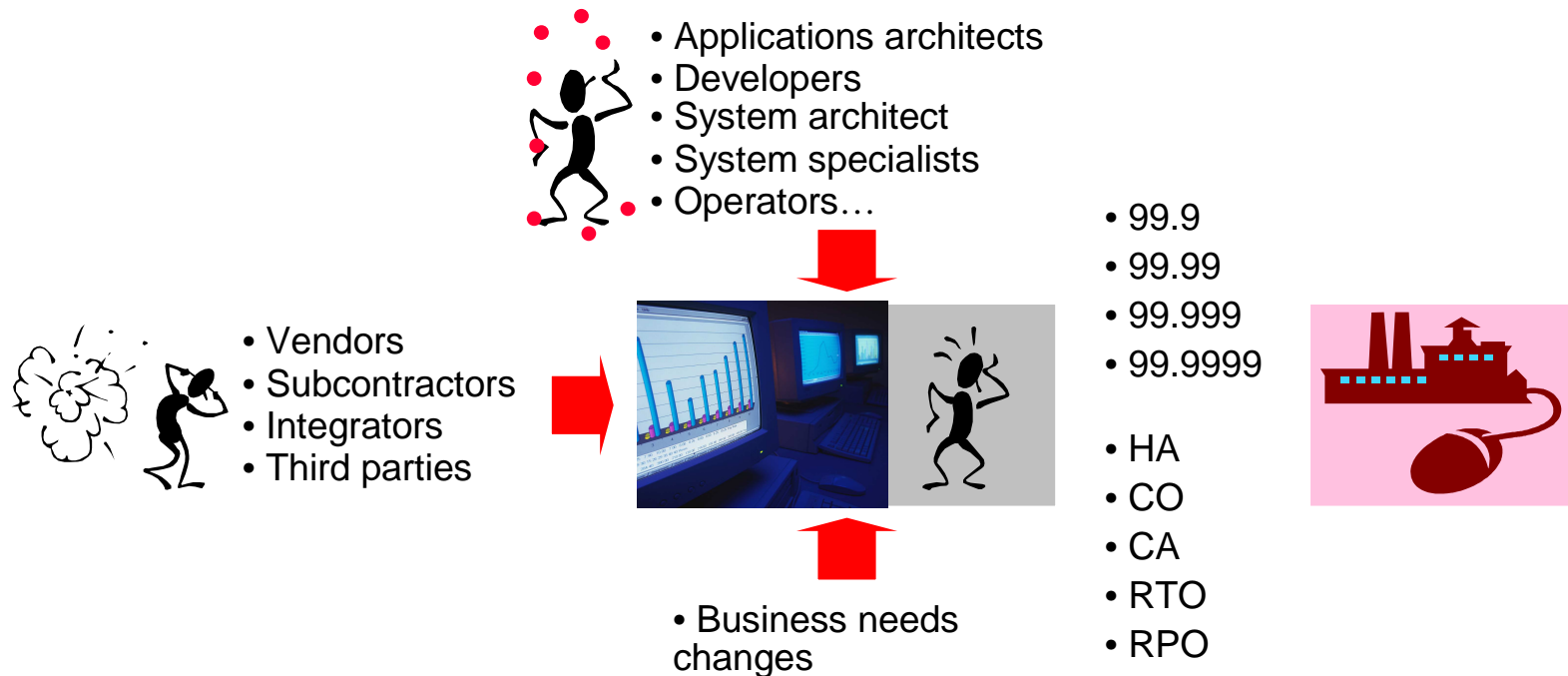


- What was an optimum investment in yesterday's support role may not be adequate for today's e-business role, which is integral to the business.
- Equal or less investment in IT results in far greater impact to the business today.

# Availability Common Inhibitors

- **Actual service delivered to the end user is often unknown**
  - End user requirements are not generally known or fully understood.
  - The IT scope is frequently narrow and focused on reporting platform level availability.
  - End-to-end availability may not be measured.
- **Investment in high availability is not fully justified**
  - Few installations fully understand the true cost of an outage
  - A common concern is a shortfall in staffing
- **Technology implementation does not employ all high availability techniques.**
  - Investment in redundancy is not fully justified and supported by sufficient capacity.
  - Product availability features are often not fully exploited
  - Complex designs are difficult to manage and can result in high volume, low quality changes.
- **Application design can be a major inhibitor to availability**
  - Availability objectives are typically NOT integrated into the application development process.
- **Change is a key contributor to instability**
  - Planning and preparation is often incomplete; too many changes are not fully tested.
- **Many problems go unresolved due to lack of identification and follow-up**

**Accountability** begins when **recognizing that there can be component outages** and **service outages**; both must be captured so that both component availability and service availability can be monitored and measured.



- ❖ **No product or development is error-free (100% Reliable)** If it's built by a human, it will fail.
- ❖ **Application software is typically focused on providing function.**
- ❖ **There is constant change due to business growth or legal considerations.**
- ❖ **No two systems are alike**
- ❖ **The system is built through an integration of several diverse components; it will fail.**
  - It probably has not been fully tested in the environment in which it is running.

## Would you fly with an airline that did not accept accountability for your safety?

- What if Air France said, “Boeing, if your airplanes never failed, I wouldn’t need to worry about safety!”
- Yet, that’s how many IT shops operate – “IBM, if your systems didn’t break, I wouldn’t need to waste time developing recovery procedures.



- The airlines are operating with > 7-nines reliability (99.999996%) and still improving.

*True, if IBM could plug in the complete end-to-end systems including applications and never change them, then making the vendor accountable might work.*

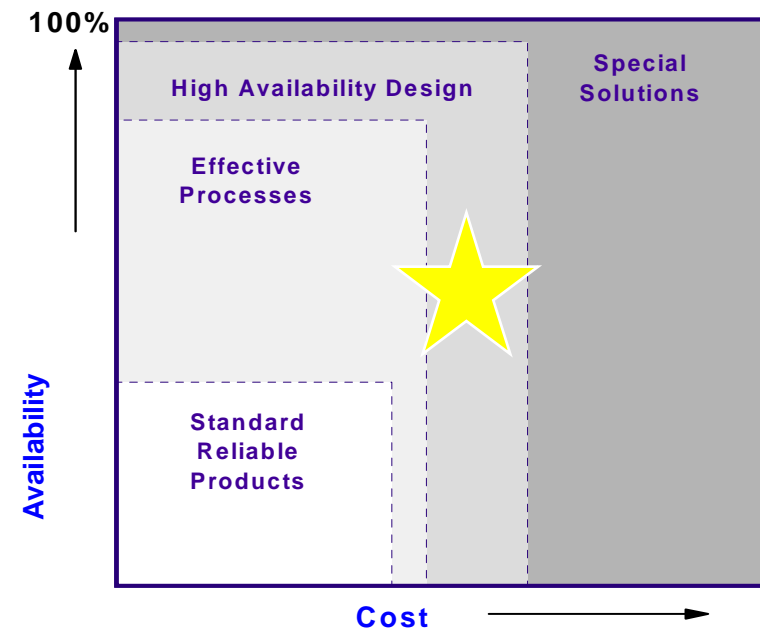
**Until then, somebody in IT must accept accountability for quality of service to their business.**

**High availability** begins with quality reliable products, but **cannot be achieved without effective supporting processes and availability design considerations.**

1. Begin with reliable products.
2. Secondly, employ effective systems management processes.
3. Then exploit availability design techniques.

Improvements can result from implementing any one, or any combination of them, but...

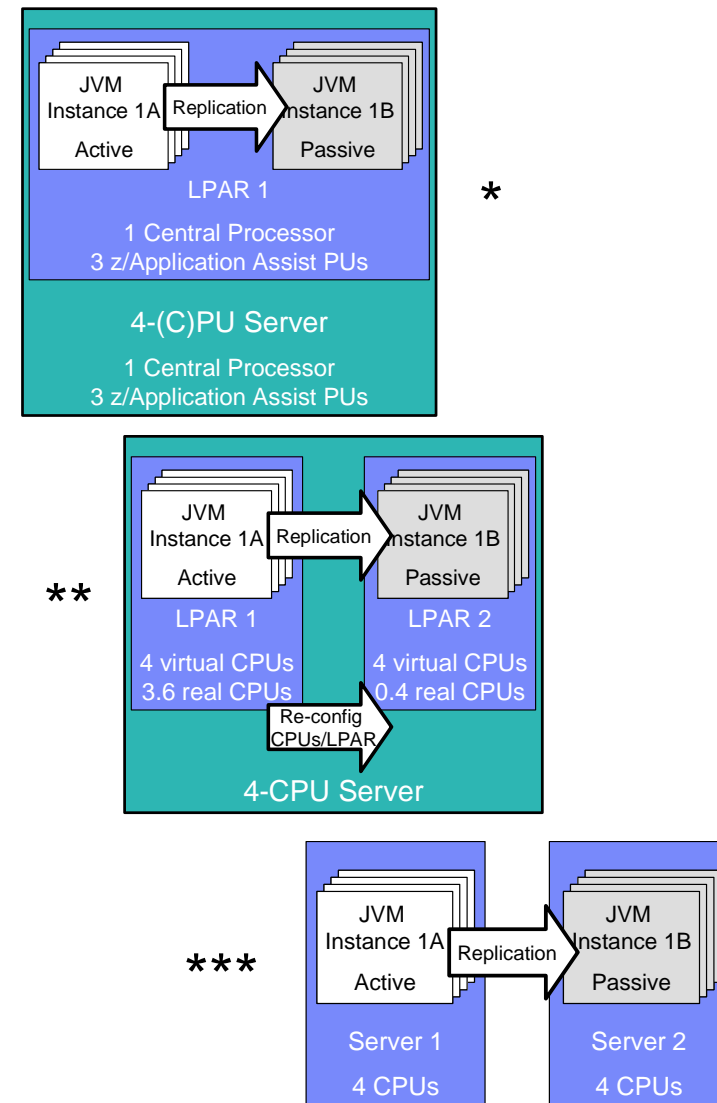
High Availability requires a balanced approach to implement ALL.



**Redundancy** is the technique of improving system availability by utilizing duplicate components in a configuration to eliminate or reduce the impact of single points of failure.

- Duplicate **WHAT**

- Application \*
- Middleware
- Operating system \*\*
- Hardware \*\*\*

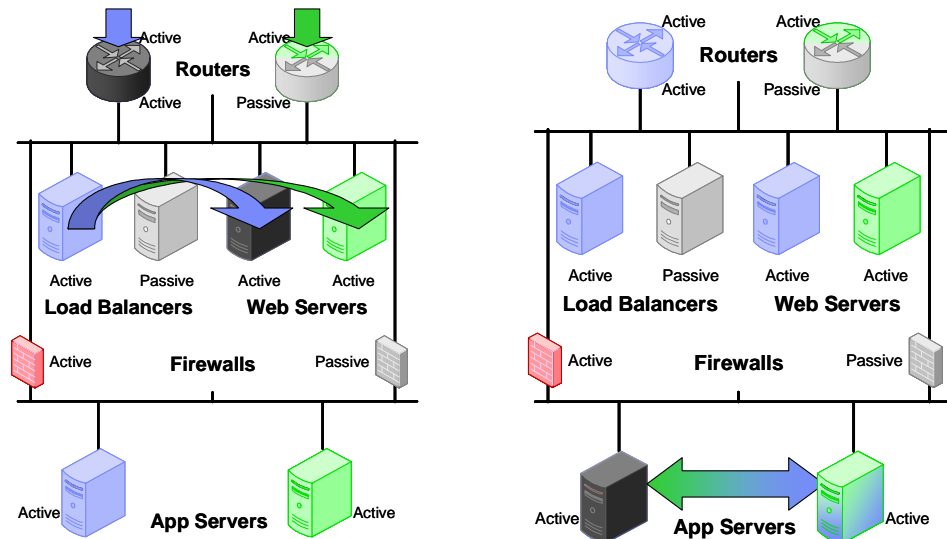


**Redundancy** is the technique of improving system availability by utilizing duplicate components in a configuration to eliminate or reduce the impact of single points of failure.

- Duplicate **HOW**

- **Active / Active**

- Load Balancing \*
- Mutual Takeover \*\*

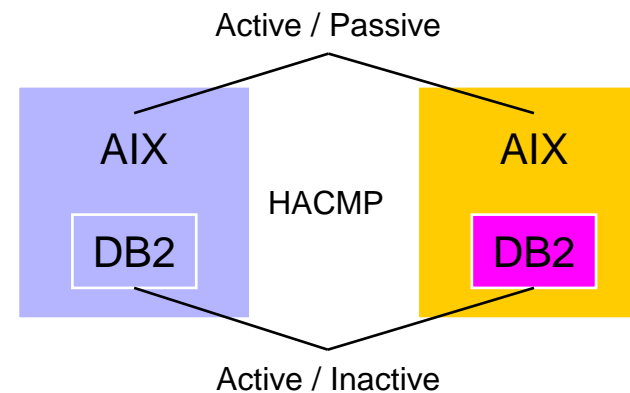


- **Active / Passive**

- Warm Standby
- 1 + 1
- n + 1
- n + m

- **Active / Inactive**

- Cold Standby



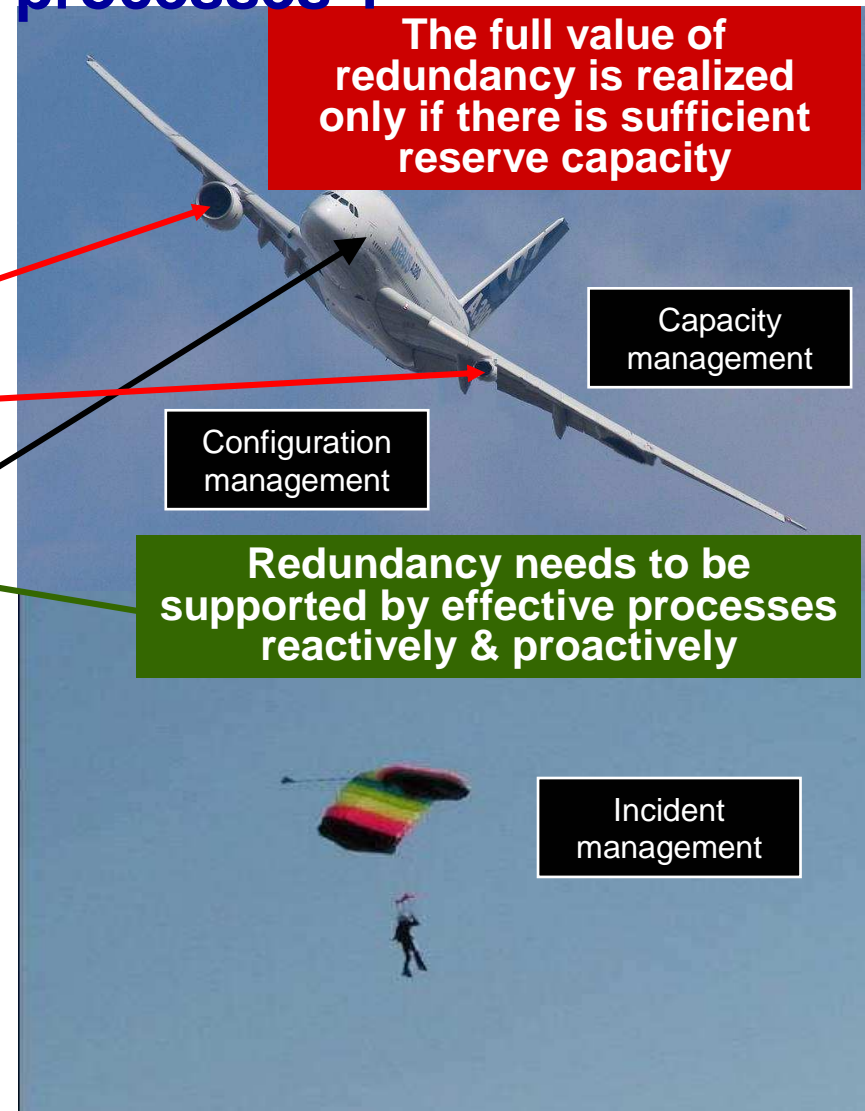
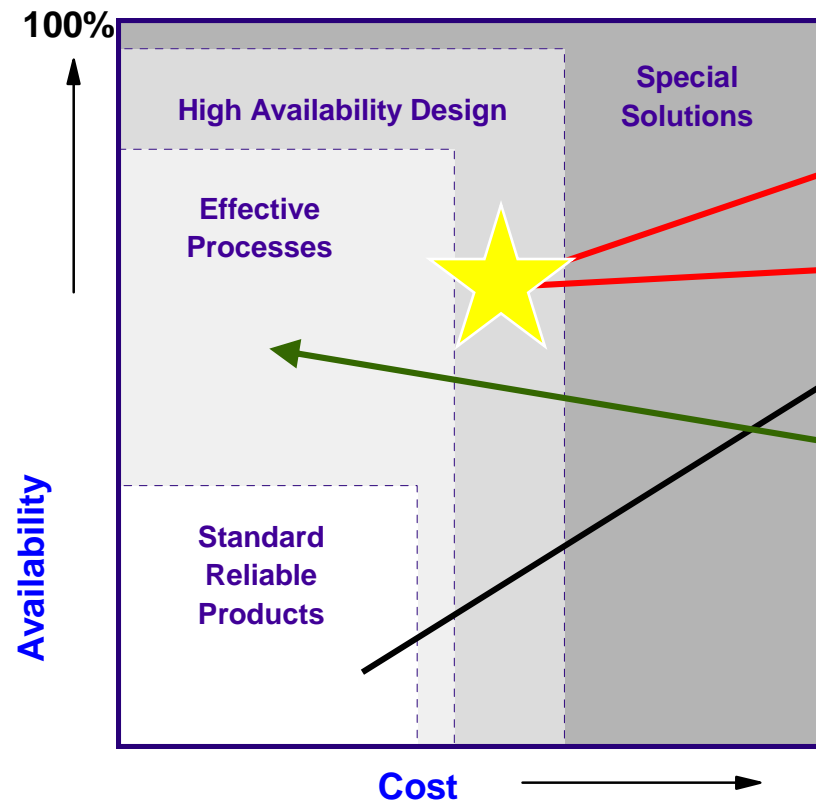
**“Ensure adequate redundancy in design so that the plant can accommodate, without damage to ship or crew, equipment or systems failures that inevitably will occur.”**

- Nuclear Submarine Guiding Principle



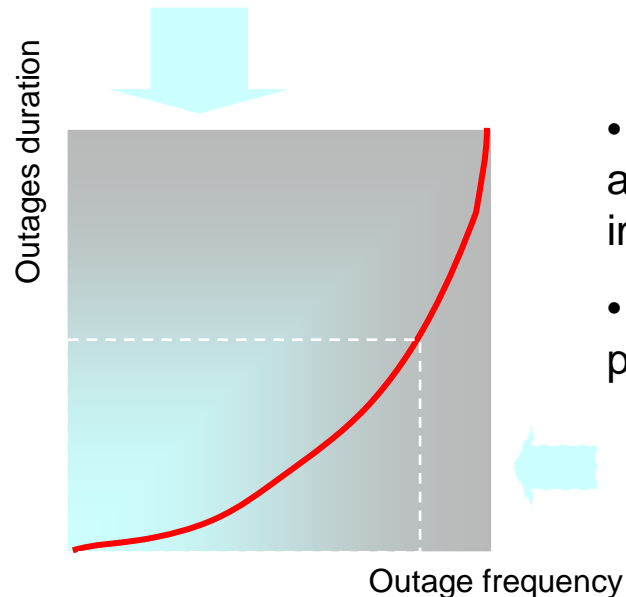
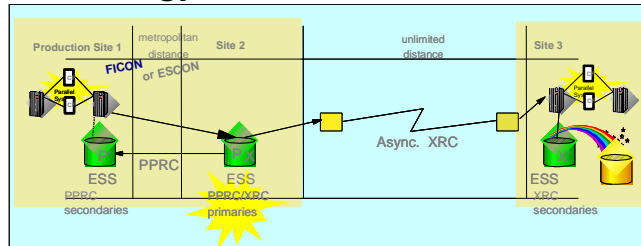


# Why HA Architecture design and redundancy design need to be complemented by effective processes ?



# Redundant architecture design mostly focus on reducing outage impact on users and business

## Technology, Architecture & Automation



- Architecture (redundancy), technology and automation mostly help in minimizing outage impact to users
- They can't repair or fix existing problems nor preventing new problems to be put in the system.



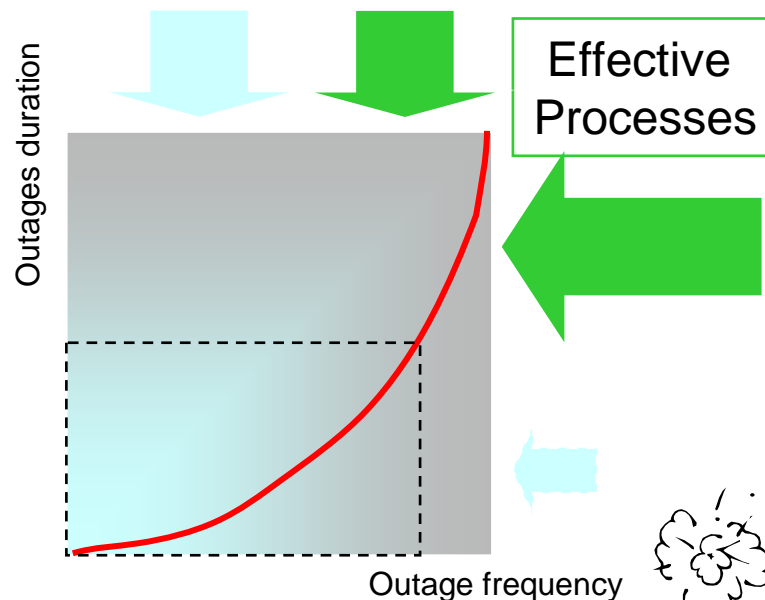
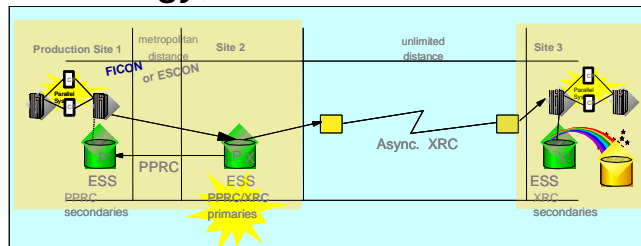
- Vendors
- Subcontractors
- Integrators
- Third parties



- Applications architects
- Developers
- System architect
- System specialists
- Operators...

High availability begins with quality reliable products and High availability design, but **cannot be achieved without effective supporting processes** considerations.

### Technology, Architecture & Automation



ITIL

- ✓ Service desk
- ✓ Incident management
- ✓ Problem Management
- ✓ Change management
- ✓ Configuration management
- ✓ Release management
- ✓ Service Level management
- ✓ Availability Management
- ✓ Capacity management
- ✓ IT Service Continuity Mgt
- ✓ Financial management for IT



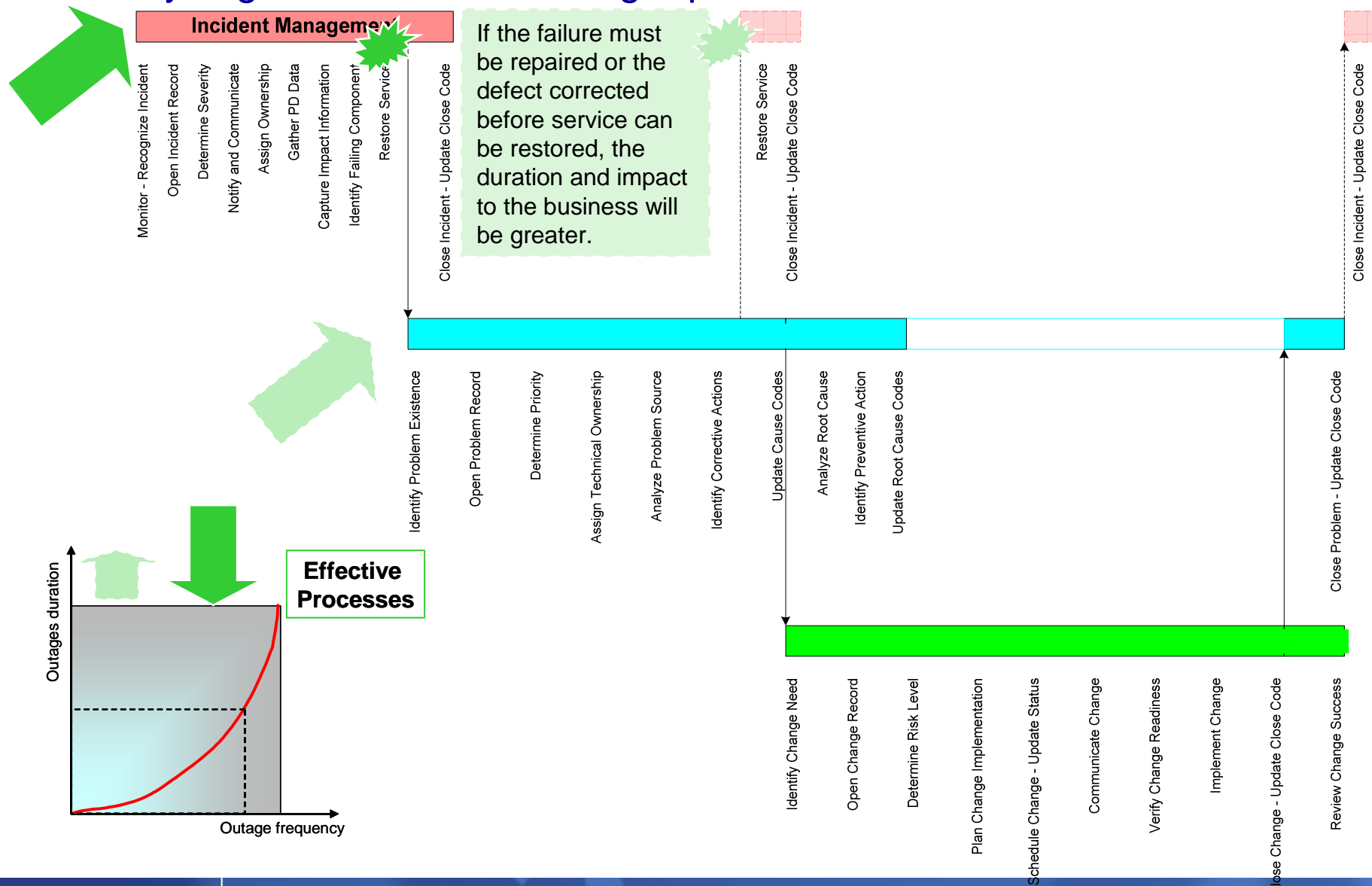
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- Third parties



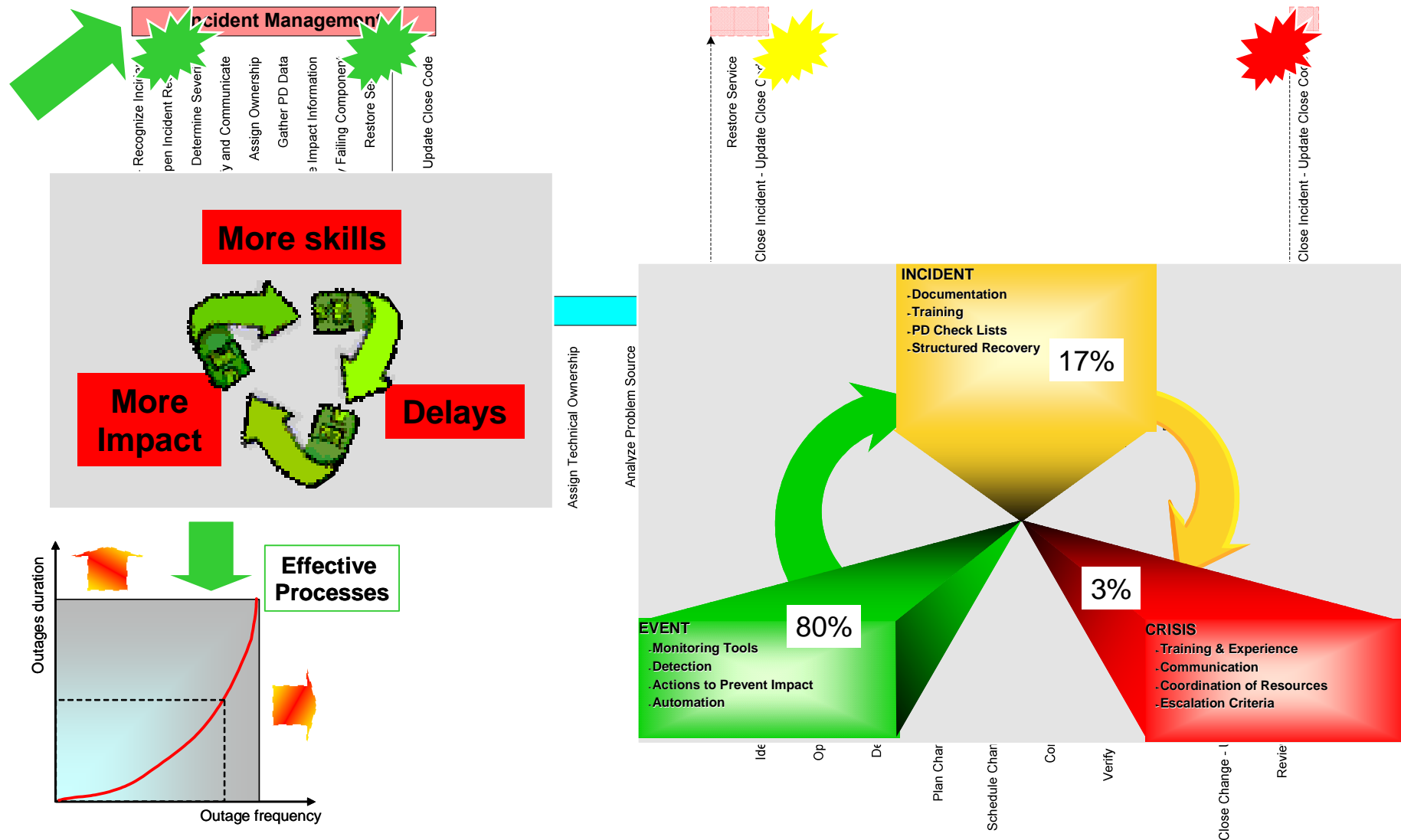
- Applications architects
- Developers
- System architect
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- Operators...

ITIL : Information Technology Infrastructure Library

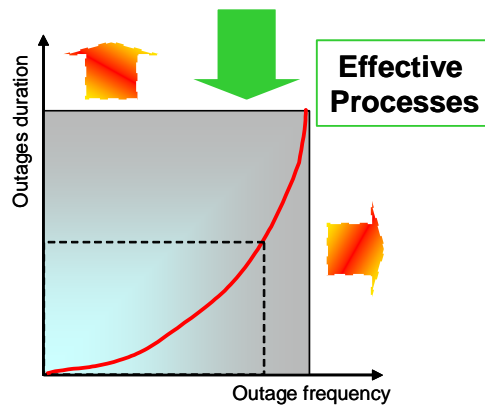
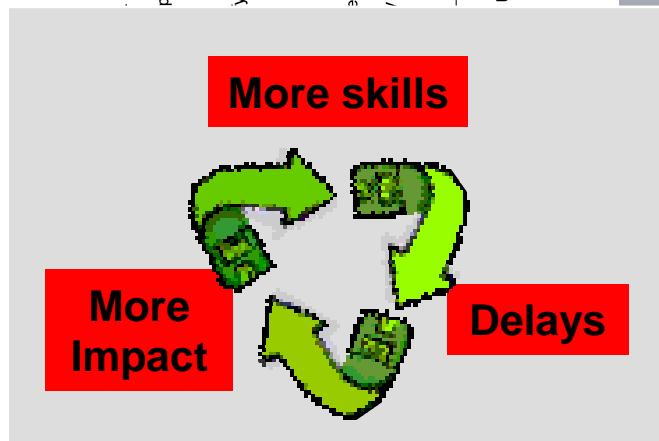
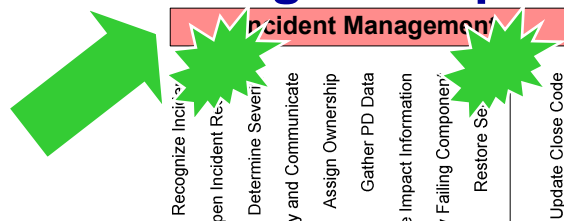
Ideally, **Incident management** aims at having service restored before analyzing the defect and taking repair or corrective actions.



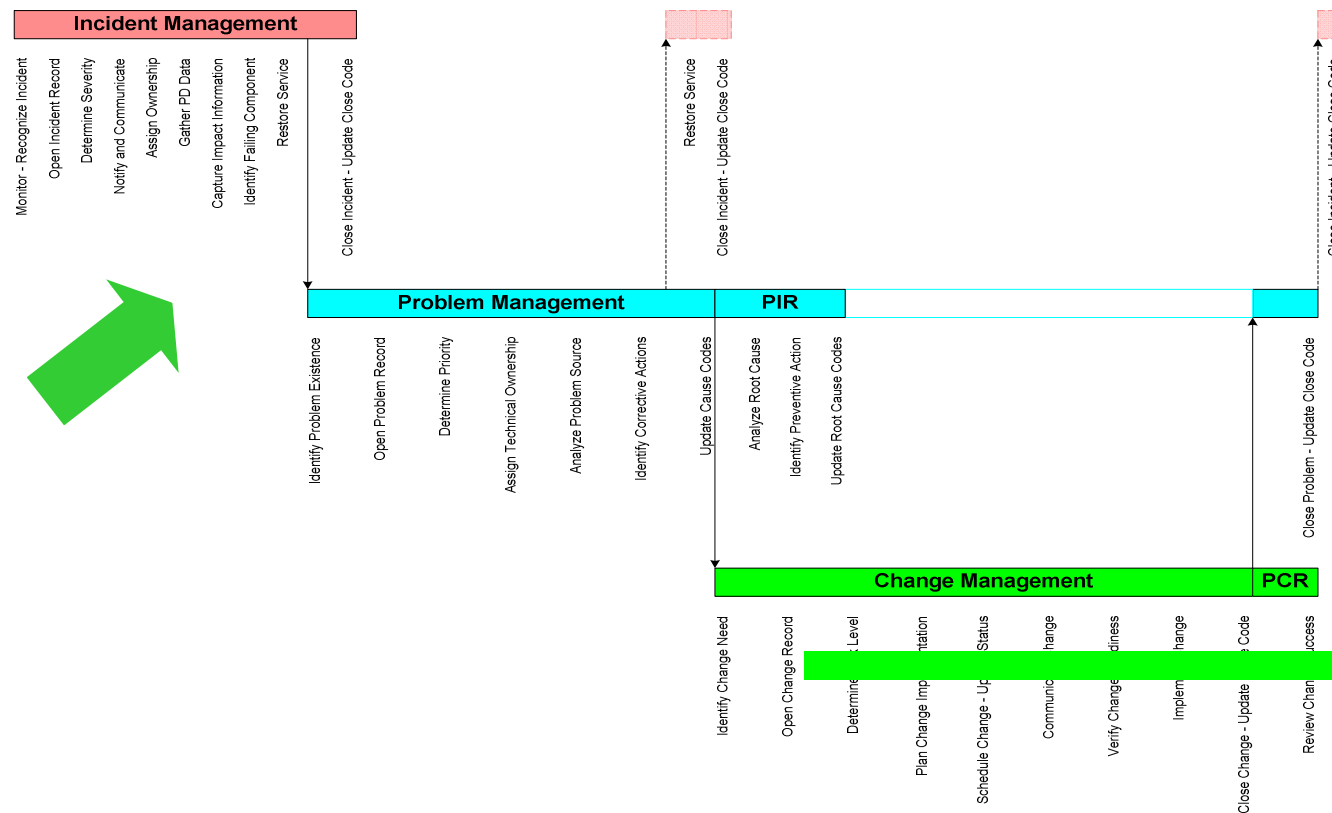
An event when **not handled expeditiously** can result in impacting incidents, which, if not resolved immediately may become a crisis, **progressively increasing the impact and the recovery time.**



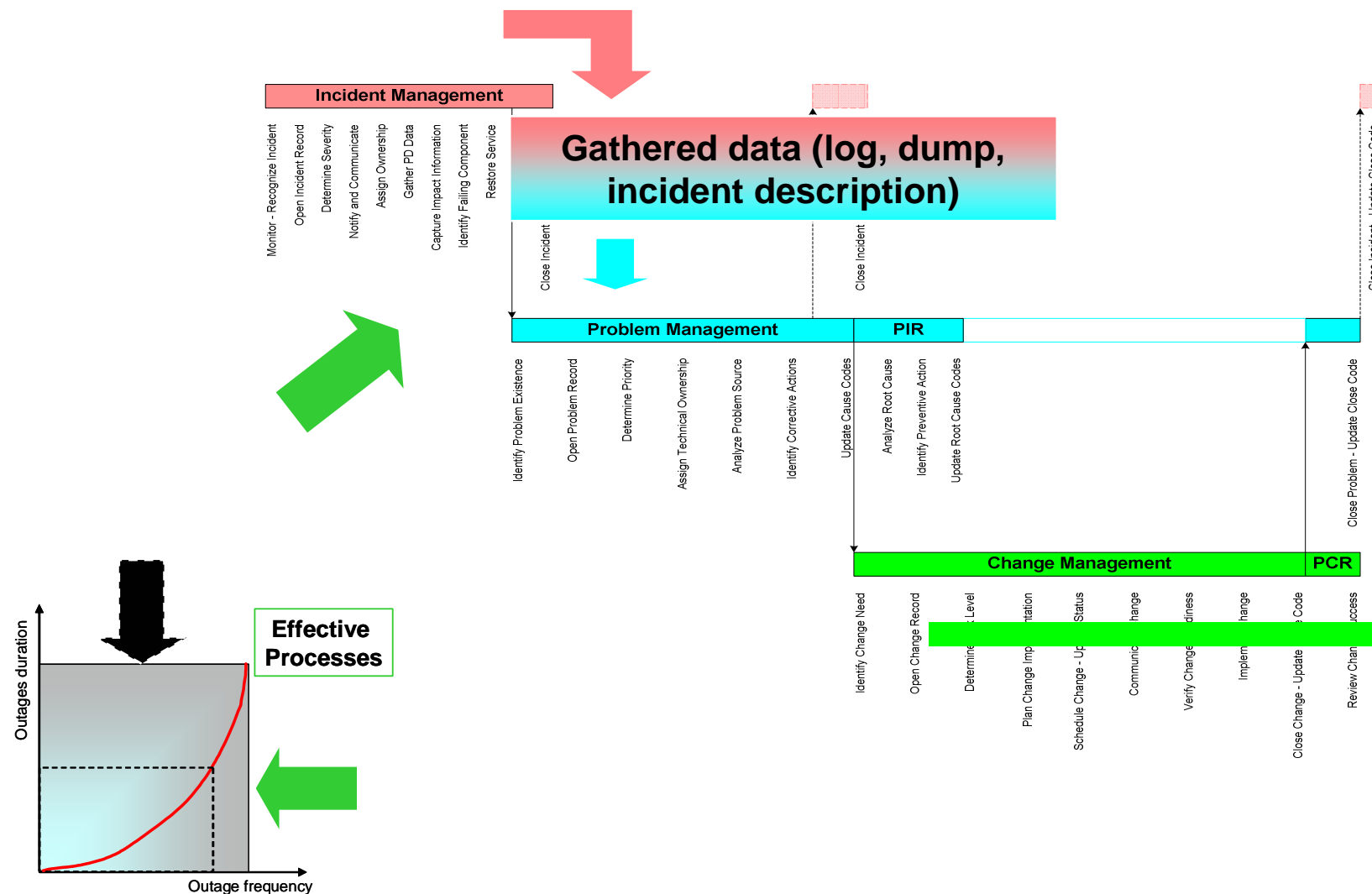
An event when **not handled expeditiously** can result in impacting incidents, which, if not resolved immediately may become a crisis, **progressively increasing the impact and the recovery time.**



Once service has been restored, **Problem management** aims at providing **corrective repair actions** as quickly as possible to **prevent recurring incidents** from being triggered by that defect.

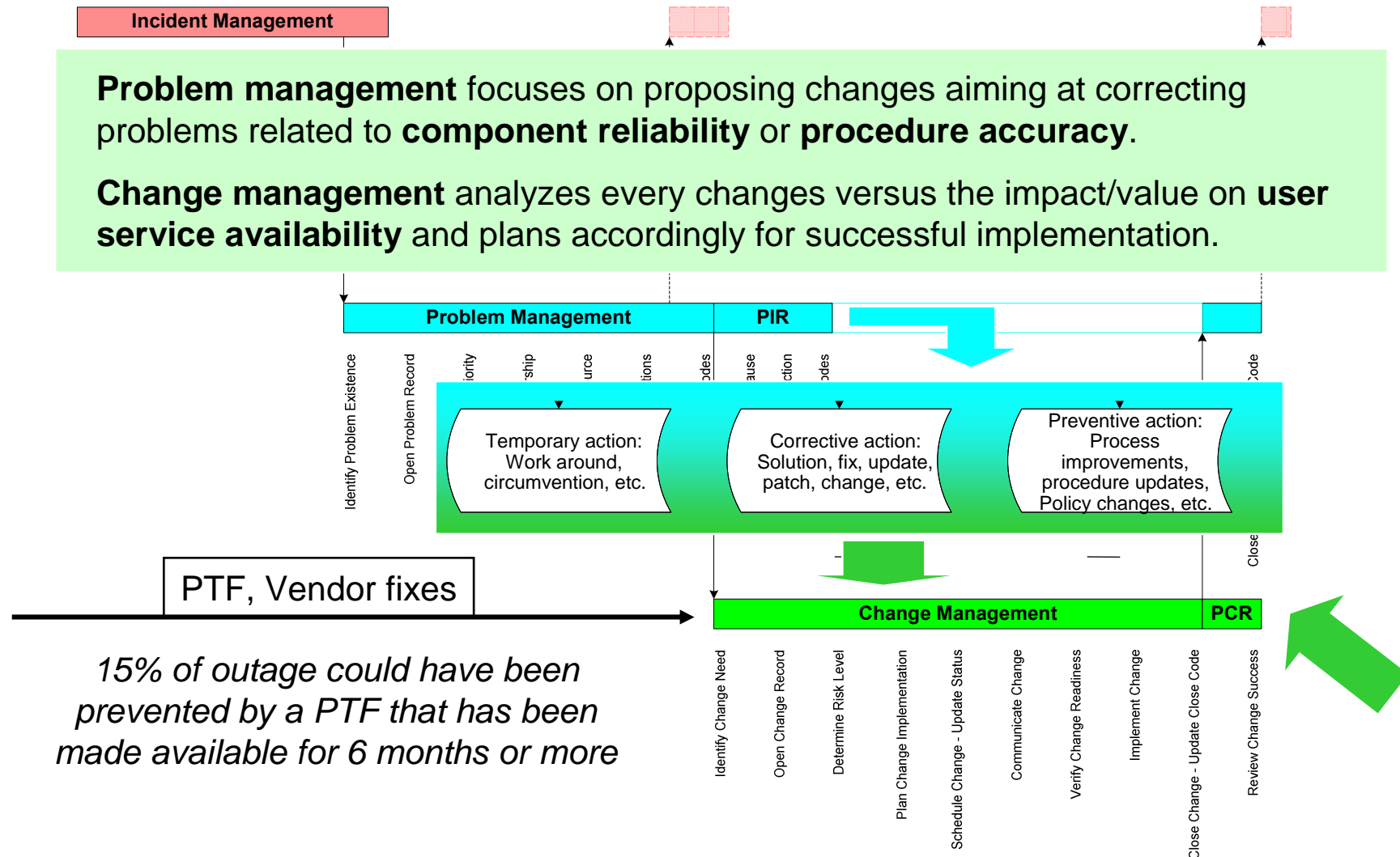


The mission of the **Problem Management** process is to facilitate the **timely correction of problems** and minimize the impact of problems on the production systems.



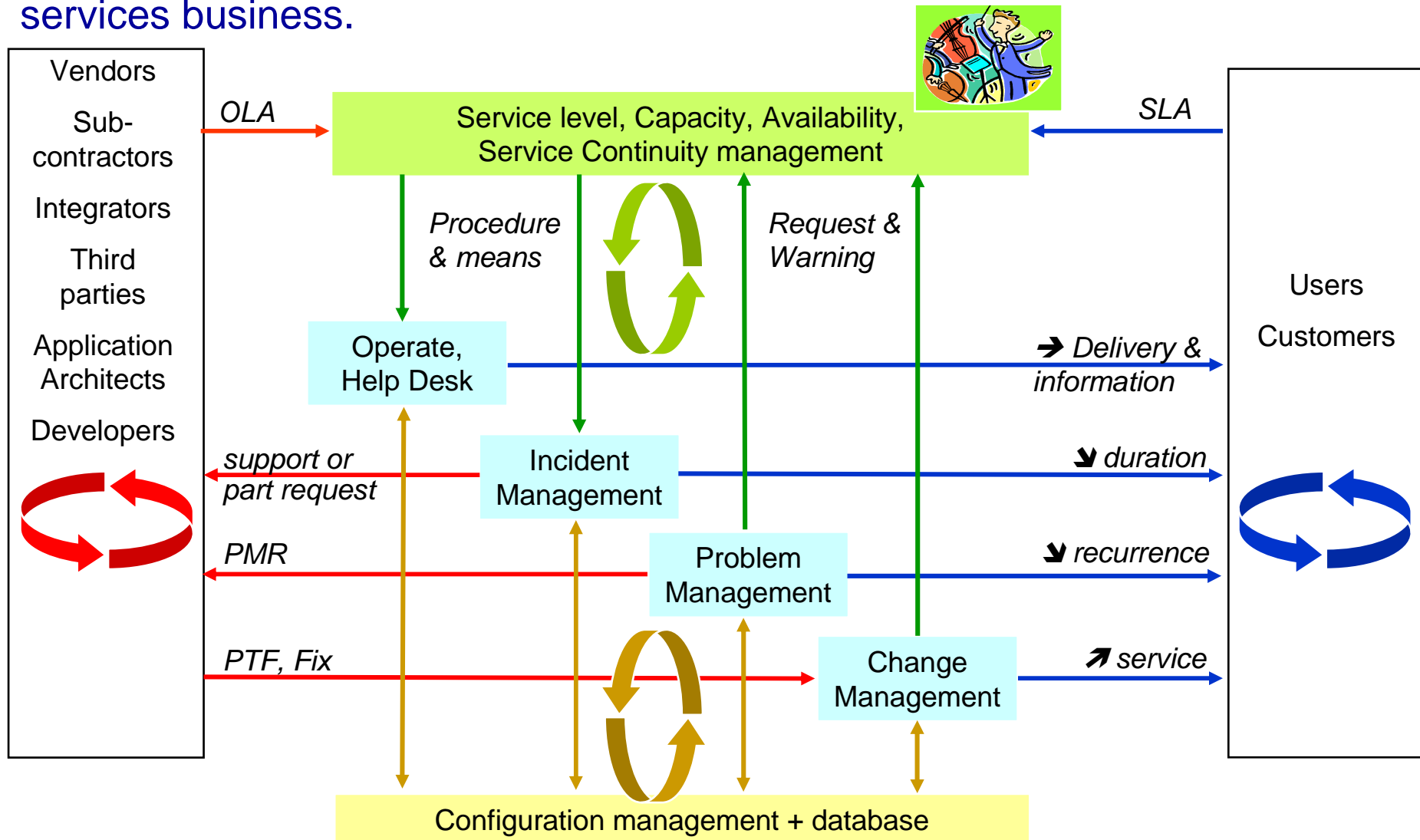


**Change Management** is the process of **planning, coordinating, monitoring, communicating, and implementing** changes affecting IT resources to ensure protection of service level commitments.

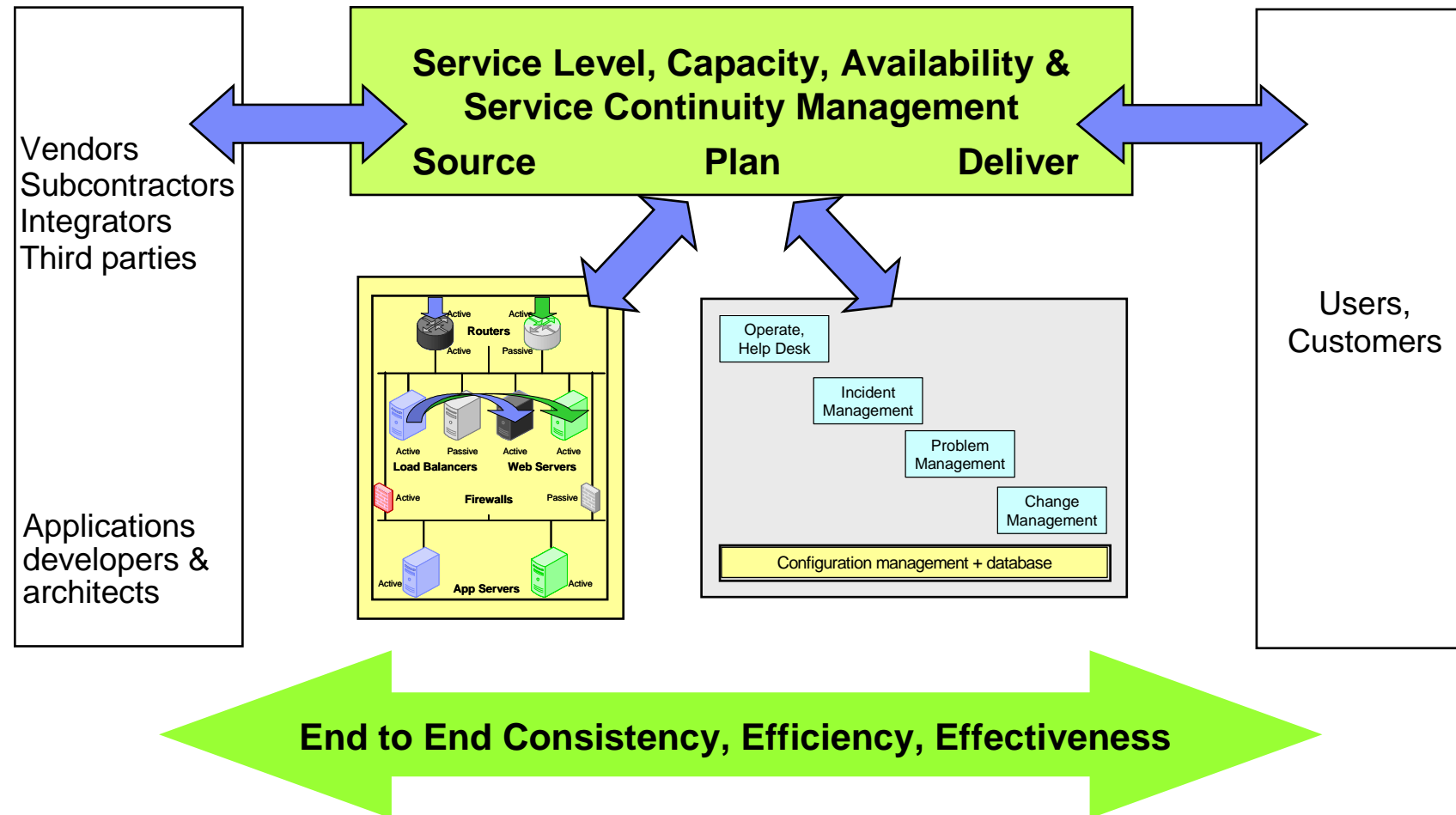


*15% of outage could have been prevented by a PTF that has been made available for 6 months or more*

Delivering quality service requires a **comprehensive service management model** describing the people, process, and information requirements of the services business.



The **Availability manager role**, consistently with ITIL, aims at providing the structure with consistent IT resources and ensuring that committed levels of systems availability meet the needs of the business.





# Would you fly this plane ?



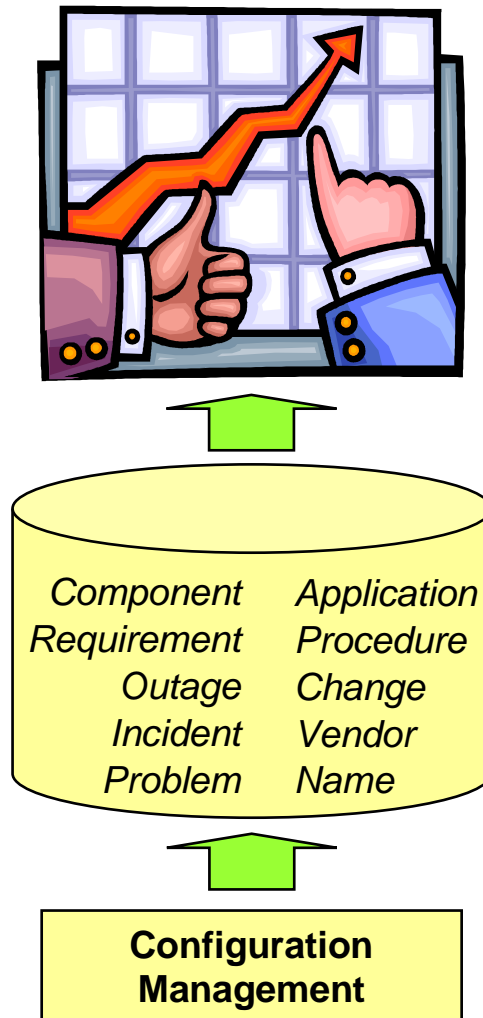
**Training Platform**

Production  
Infrastructure HA &  
D/R Qualification  
Test



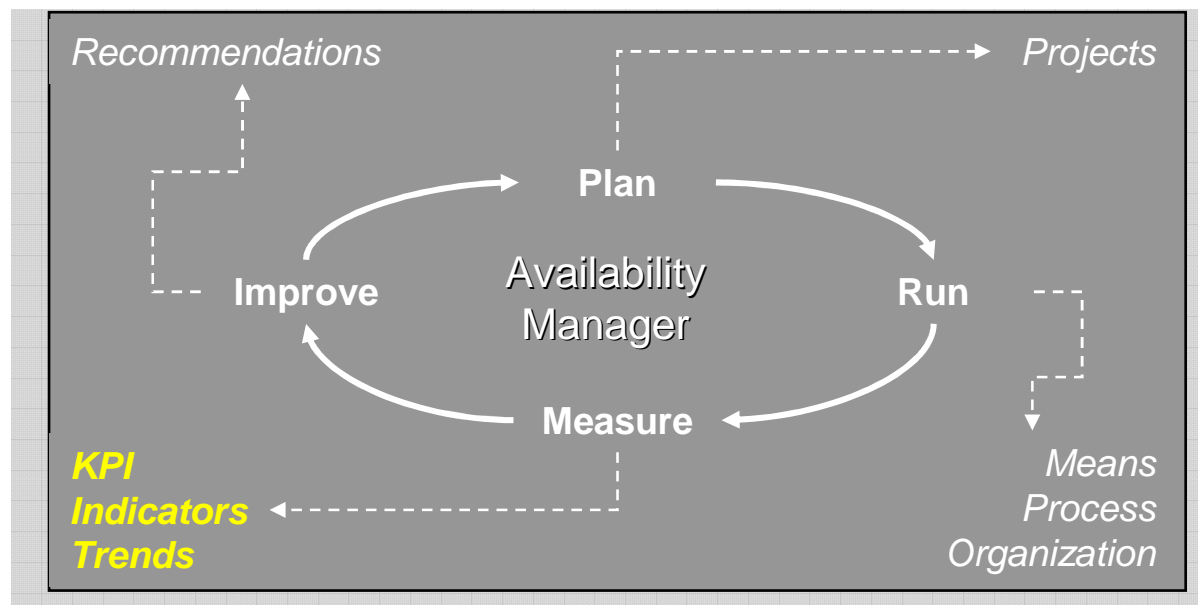
**Capacity Planning  
assessment**

**Measurement and trends analysis of HA performance versus SLA objective are key activities of Availability Manager.**



**Design for HA +  
D/R (Redundancy  
+ automation)**

**SL Management,  
SLA Objectives  
definition**




**Platform HA  
Components efficiency  
measurement**

**Processes  
efficiency  
Measurement**

# High availability Approach

- *Develop and Maintain an **Availability Strategy***
  - Provides a long term plan for supporting and improving availability
- *Provide Availability **Education***
  - To share proven techniques and sensitize the IT staff to their role in achieving high availability
- *Assess New **Application Readiness***
  - To support the specified availability requirements
- *Define and Implement **Effective IT Management Processes***
  - To support the service level objectives
- ***Analyze Gaps** in the technology implementation, process effectiveness, and staff skills to identify improvement opportunities*
- *Perform **Post Incident Reviews***
  - Analyze individual outages
  - Identify root cause
- *Conduct Systems **Outage Analysis** of recent outages*
  - Analyze trends and failure patterns & identify areas of opportunity within technology and processes

## Agenda

- HACoC Team
  - Missions
  - HA Assessment Process
- Availability Concepts and Approach
-  ■ Disaster Recovery Solution : Implementation experience

# Disaster Recovery: Long Distance Solutions

*When determining the location of a secondary site, organisations must ensure that the distance between data centres is great enough to prevent a single localised disaster from taking down both sites*

## Site Selection: Geographical Location

**Location Selection process will consider:**

- Natural disaster potential
- Telecommunication
- Electric Power Capacity
- Country Risks ...

## *The effect of regulation and legislation*

- Measures in the Basel II accord
- Sarbanes-Oxley
- ...

## Disaster examples

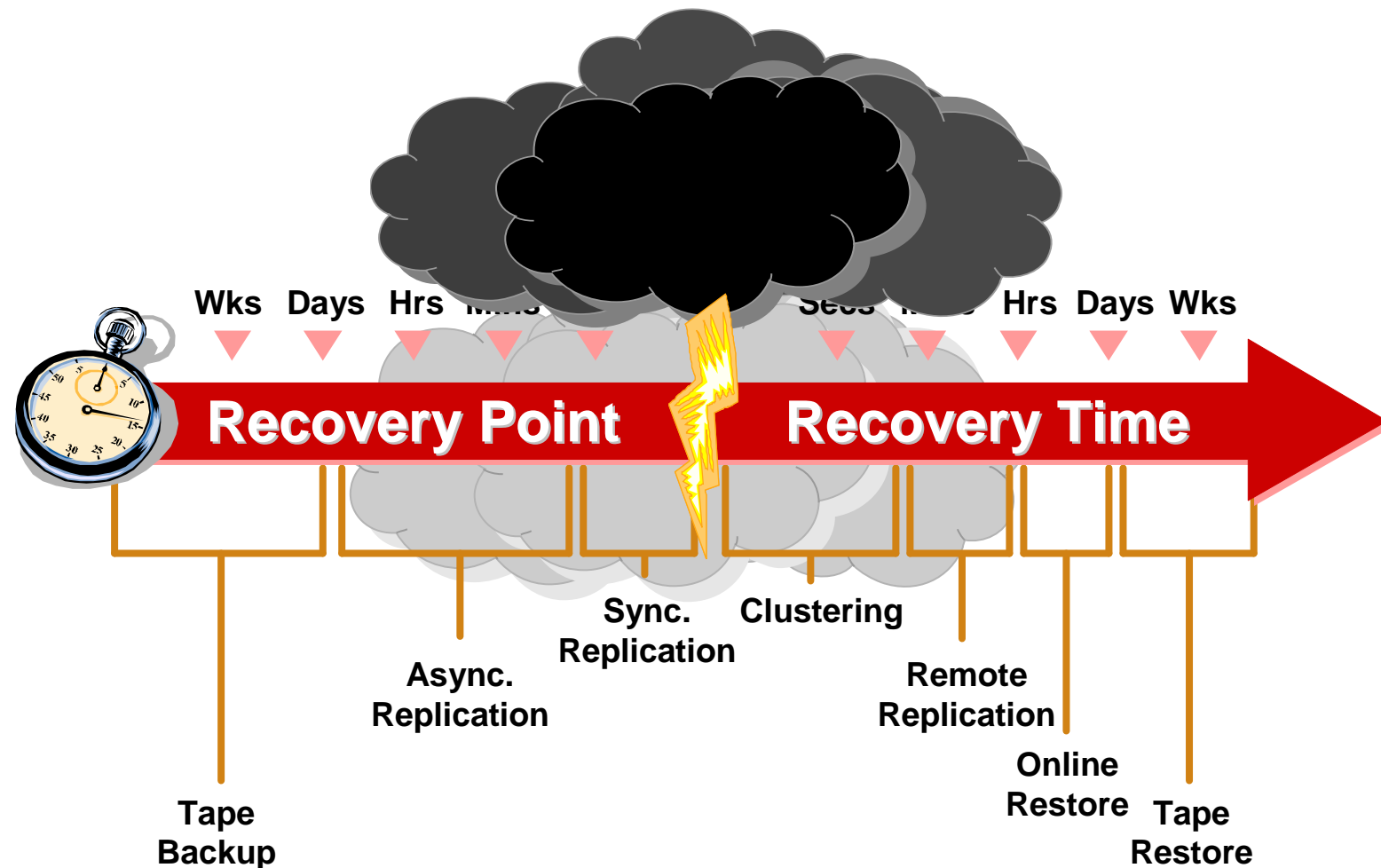
Power outage	Italy Denmark & Sueden Russia	September 2003 September 2003 May 2005
Earthquake	Pakistan, Afghanistan and India	October 2005
Terrorism	New York City - USA	September 2001
Tornadoes	- Israel, Carolina – USA - Germany	2005 Mars 2006



# Disaster Recovery Projects Phases

- Project Initialization
  - ❖ Top management commitment
  - ❖ Team and responsibilities
- Data Collection
- Business Impact Analysis: Determine priorities
- Risk Assessment: Determine Vulnerabilities
- Strategy Design: Choose Recovery solution
- Manage the implementation: Recovery Plan Phase
  - ❖ Plan documentation
  - ❖ Testing and training phase
  - ❖ Maintenance phase

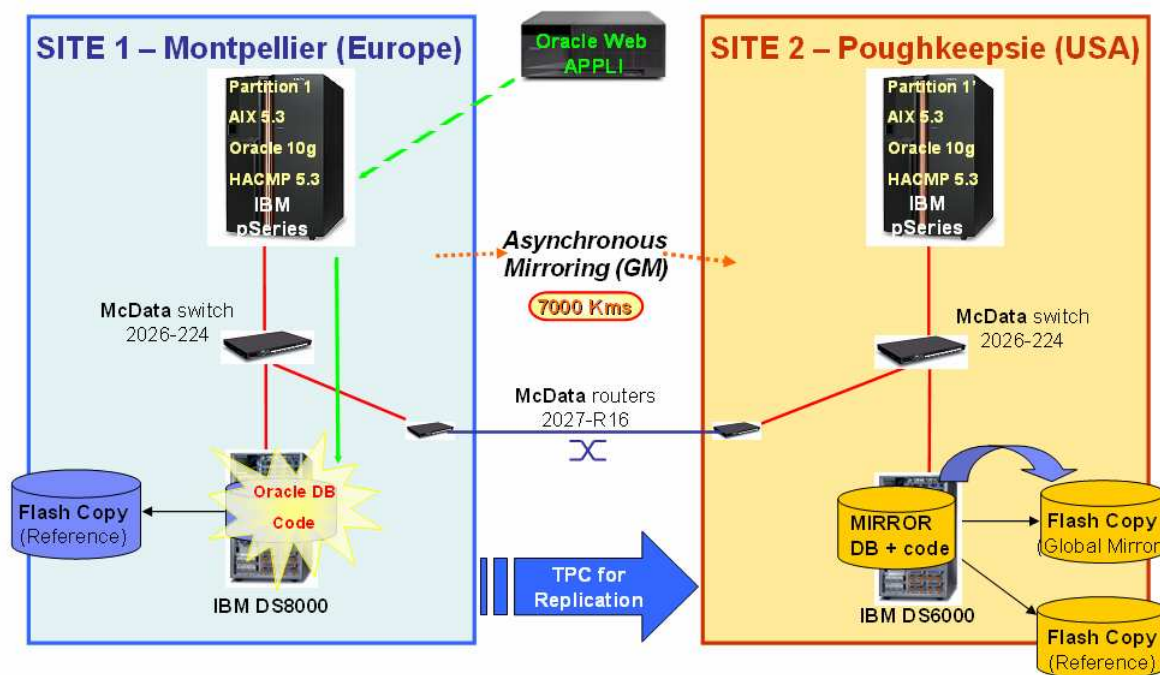
# Timeline of an IT Recovery



**RPO:** How much data loss can I accept?  
How many minutes' or hours' data has been lost

**RTO:** The time it takes to get your servers and applications up and running again

## Implementation Experience: Disaster Recovery solution between Montpellier and Poughkeepsie named "cross Geos HA solution"



### Objectives :

- Answer the customers current business Top priorities: Business Continuity (HA, DR, BR)

- **Hardware :**
  - DS8000 / DS6000
  - System p
  - McData equipments
- **Software :**
  - AIX
  - HACMP
  - Oracle 10g
  - Oracle eBS
- **Copy Services :** Global Mirror, Flash Copy



## Cross Geos HA Solution: Basics Requirements

**What is your RPO recovery point objectives and RTO ?**

- \* RPO : 30 mn
- \* RTO : less than 4 Hours

**What disaster recovery Tier are you at today?**

- \* Tier 6

**What is the distance between your two sites?**

- \* Distance: 7000 kms

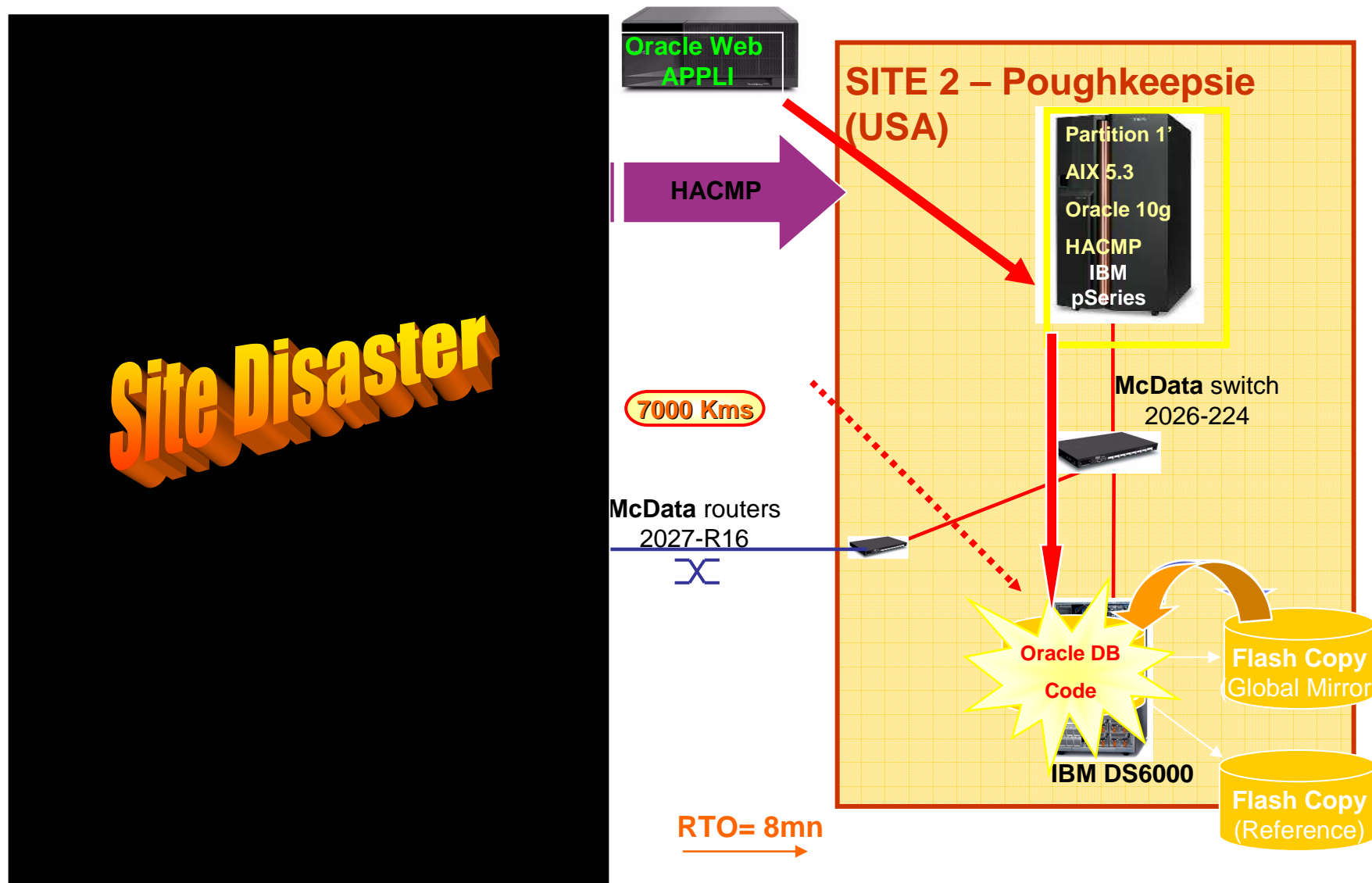
**What host platform(s) do you use: zSeries, Open Systems or mixed data**

- \* System p

**. What is the desired level of recovery?**

- \* Planned/Unplanned Outages

## Long Distance Disaster Recovery Solution: Demonstration



# Cross Geo HA Solution: The Different Blocks

- Network
  - **Internet**

Average transmitted rate is 3.57Mb/s  
Average Latency round trip 100ms  
Effective throughput (with compression) 1MB/s  
Compression Ratio was around 2.6
- SAN long distance interconnect
  - **McDATA ifcp router**
- Storage Advanced Copy Services
  - **Global Mirror**

6 volumes
- System p
  - **Oracle** database and application : **150 GB**
  - **HACMP (Failover: about 8mn )**

## Cross Geos HA solution: Disaster Recovery Scenarios

The purpose of this proof of concept was to demonstrate:

- A end-to-end solution based on Global Mirror advanced function
- Several failures/disaster cases and the failover (8 minutes) / failback process (8 minutes)
- The consistency of the data at the remote site
- The automation of the Oracle client connection

## Conclusion

- The HACoC is a Worldwide Team working with clients to define tactical and strategic steps to improve Availability
- Availability must be managed as a project to realize significant improvements
- Improvements span applications and systems design as well as the implementation of effective systems management process
- The defined service level objectives must be in line with the business requirements





HACoC-Europe

***Thanks !***