

# ADITI

*Technology inspired by nature*



# Contents

1. Introduction
2. Aditi Concept
3. Aditi Architecture
4. Aditi Technologies
5. Final Remarks

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- 1. Introduction**
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# Background

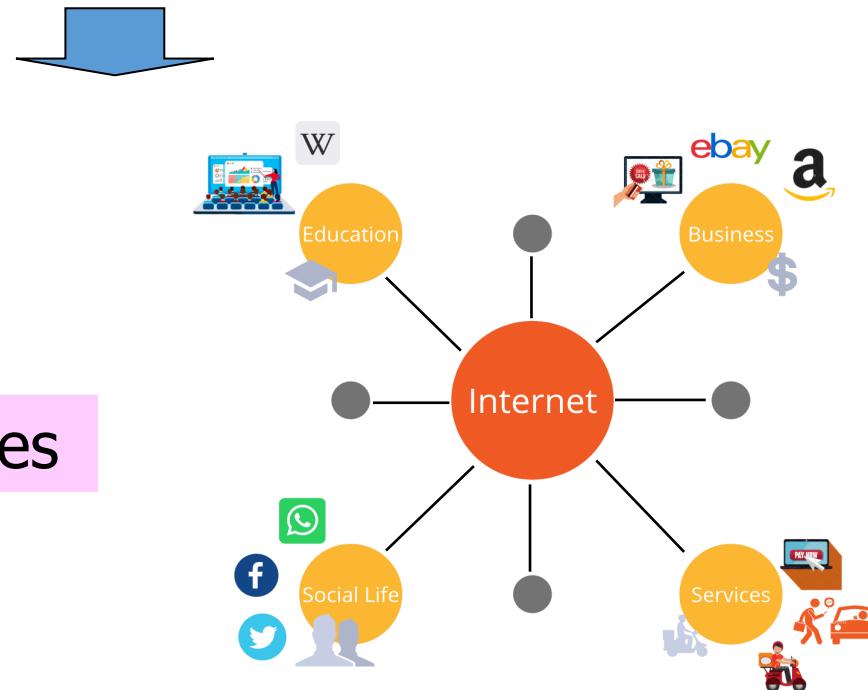
## Advancement in the IT

- Faster and more reliable computers and networks
- Cost reduction
- New devices with several capabilities

Technology is changing our lives

## Widespread use of the Internet

- Online Population
  - 2017: 7.40 billion
- Number of Websites
  - 2019: 1.94 billion



The Digital World

## Globalization

- Anyone, Anytime, anywhere
- Everything on demand

# Mission Critical Information Systems (MCIS)

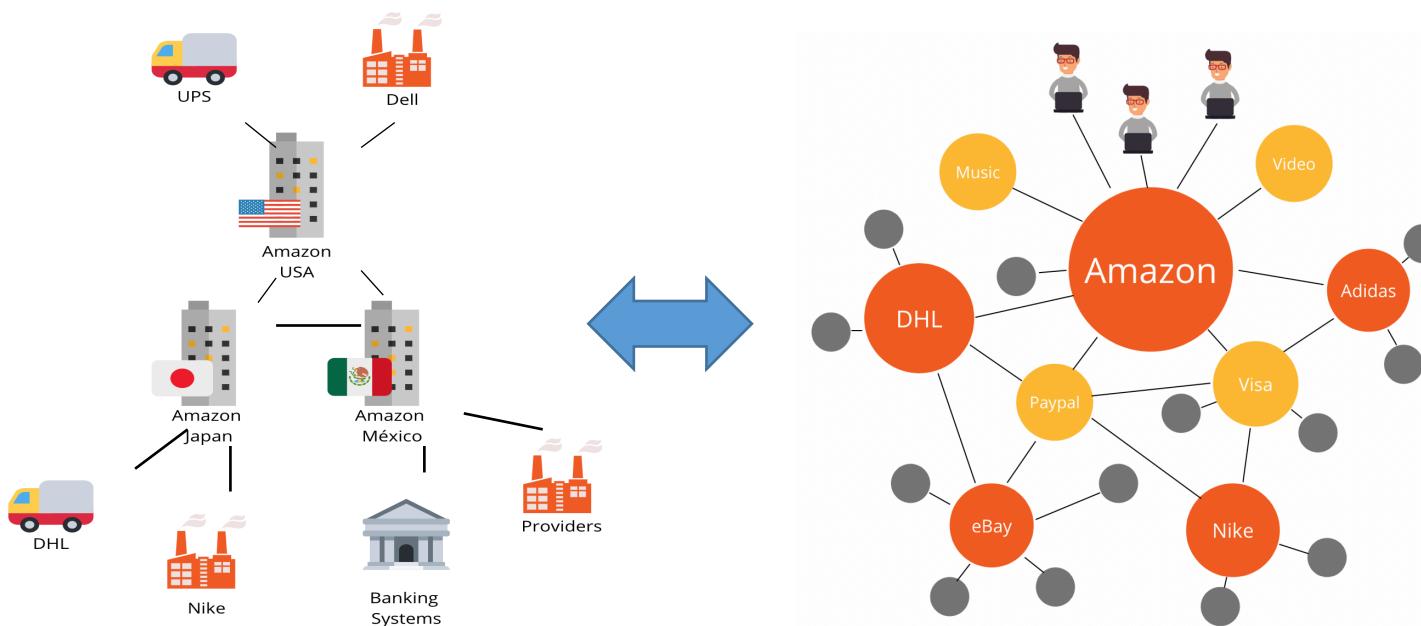
Internet based business environments e-business, e-commerce, e-trading, etc.

## Users

- New users continuously increases
- Changing preferences (location and time)
- Unpredictable situations
- Demand of new services

## Providers

- Form strategic alliances
- Competitiveness and cooperation
- Heterogeneous needs
- Large scale provision systems



## MCIS

- 2017 Online Spending: \$2.3 trillions
- 23% year over year e-commerce growing
- 2017 Mobile commerce revenue: \$700 billion
- 2018 Global digital buyers: 1.8 billions
- The number one reason people shop online is because they can shop 24/7

# Requirements for MCIS

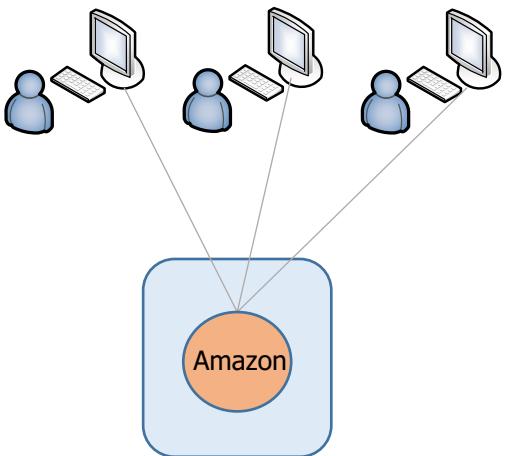
Users Needs	Service Providers Needs	System Needs
<ul style="list-style-type: none"><li>• Demand for heterogeneous services (buying, renting a movie, etc.)</li></ul>	<ul style="list-style-type: none"><li>• Provision of heterogeneous services (Amazon retail, Amazon video, etc.)</li></ul>	<ul style="list-style-type: none"><li>• Adaptability</li></ul>
<ul style="list-style-type: none"><li>• One click response</li></ul>	<ul style="list-style-type: none"><li>• High response service provision</li></ul>	<ul style="list-style-type: none"><li>• Timeliness</li></ul>
<ul style="list-style-type: none"><li>• Continuous service utilization</li></ul>	<ul style="list-style-type: none"><li>• Non-stop service provision</li></ul>	<ul style="list-style-type: none"><li>• Availability/Reliability<ul style="list-style-type: none"><li>• Fault tolerance</li><li>• Online properties</li></ul></li></ul>
<ul style="list-style-type: none"><li>• Demand for new services (IT, supermarket, etc.)</li></ul>	<ul style="list-style-type: none"><li>• Provision of new services</li></ul>	<ul style="list-style-type: none"><li>• Flexibility</li></ul>
<ul style="list-style-type: none"><li>• New users or unpredictable situations (Christmas, Black Friday, etc.)</li></ul>	<ul style="list-style-type: none"><li>• Maintain the level of service regardless of changes in demand</li></ul>	<ul style="list-style-type: none"><li>• Scalability</li></ul>
<ul style="list-style-type: none"><li>• Security service utilization</li></ul>	<ul style="list-style-type: none"><li>• Security service provision</li></ul>	<ul style="list-style-type: none"><li>• Security</li></ul>



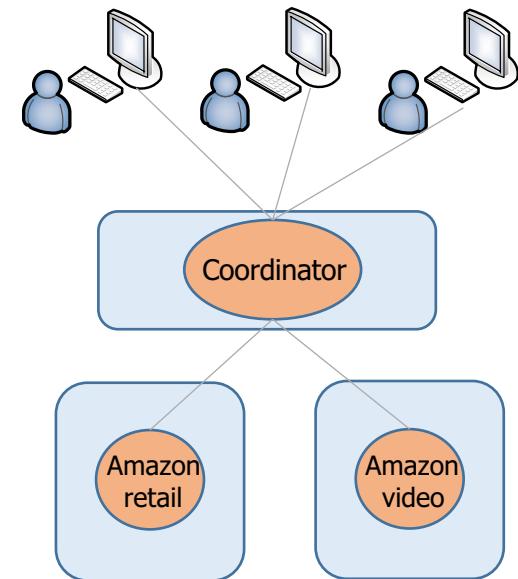
High-Assurance in Mission Critical Information Systems

# Conventional Solutions

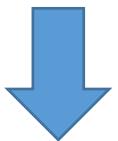
## Centralized architecture (standalone)



## Distributed architecture (application server)



- Single point of failure
- Bottlenecks
- Off-line maintenance
- Regressive testing
- Global information
- Off-line migration
- Costly scale-up



Autonomous Decentralized IT Infrastructure (ADITI)

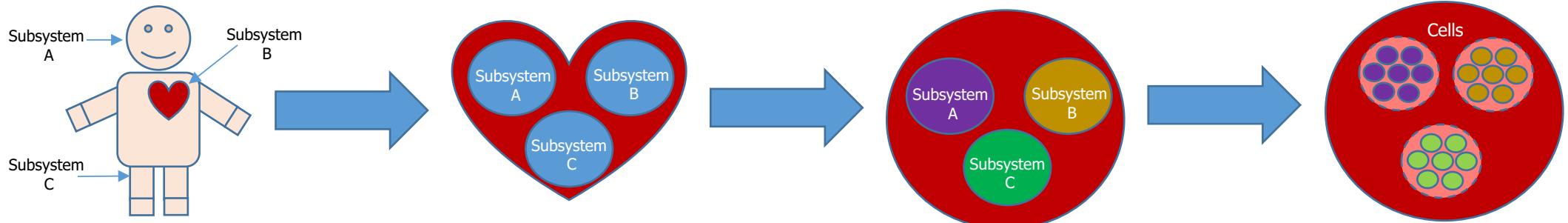
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# ADITI Concept

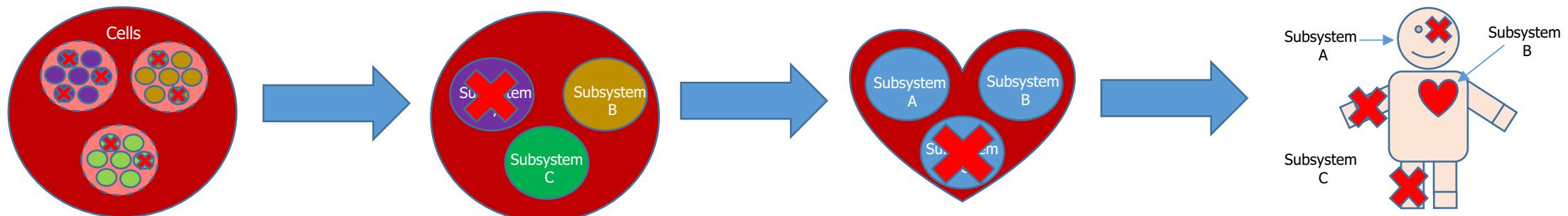
Decentralized approach (inspired by nature - cellular theory)

## Cellular composition



- Living things perform effectively by virtue of the biological operations of the functional organisms.
- Living organisms are made up of cells, that they are the basic structural/organizational unit of all organisms, and that all cells come from pre-existing cells.

## Survival/fault tolerance

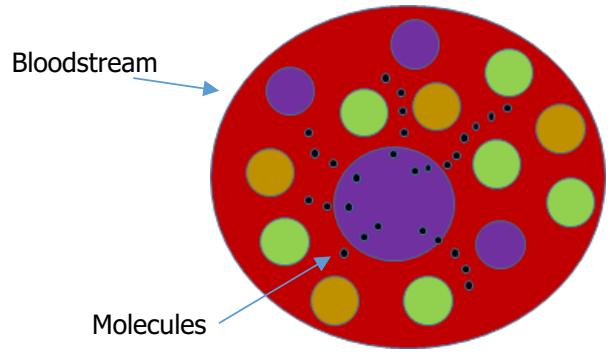


- Autonomous controlability: Any subsystem can select, in case of failure of other subsystems, their control to shift from the given initial value to another given value in finite time.
- Autonomous coordinability: Any subsystem can select, in case of failure of other subsystems, their control to attain equilibrium of their objectives.

# ADITI Concept

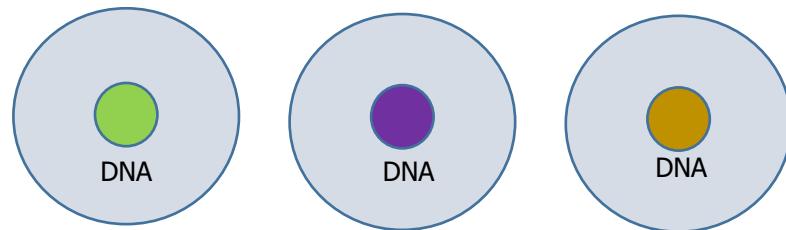
Decentralized approach (inspired by nature - cellular theory)

## Endocrine communication



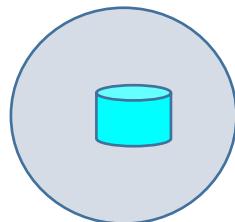
- Cells communicate each other by sending molecules through the bloodstream

## Homogeneous structure



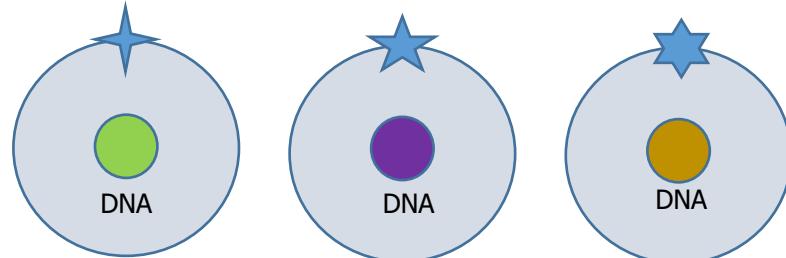
- The functions performed by a cell are coded in the genetic code (DNA)
- A cell is programmed to perform certain functionality

## Cellular memory



- Cells are capable to store information

## Communication with external elements

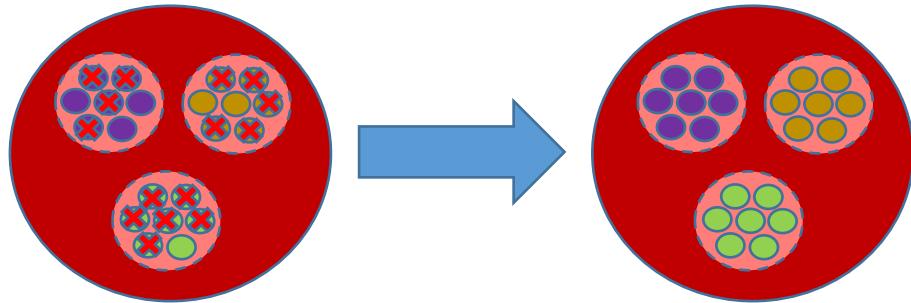


- Some cells have to interact with external elements

# ADITI Concept

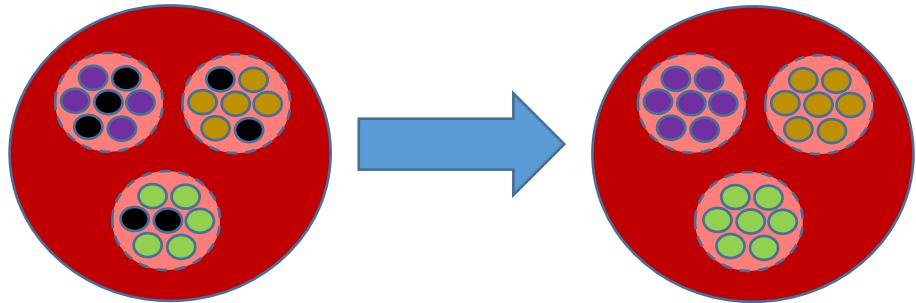
Decentralized approach (inspired by nature - cellular theory)

## Self healing organisms



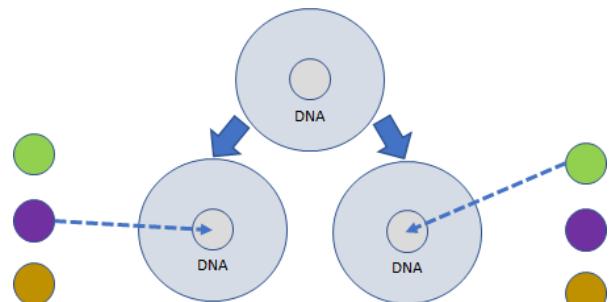
- In the presence of cell failures, self healing is activated

## Cell suicide (apoptosis)



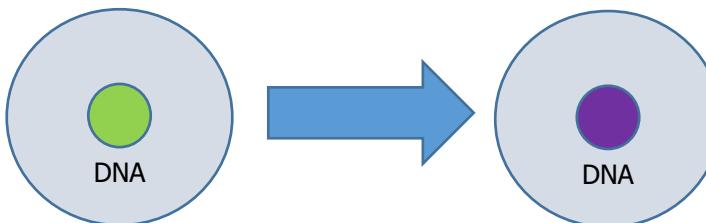
- When a cell is no longer operational, it commits suicide in order to free up resources (let a new cell live)

## Cellular configuration



- At some point in the mitosis process the cell is configured to perform specific functions contained in the DNA

## Cellular reprogramming (Induced pluripotent stem cell)

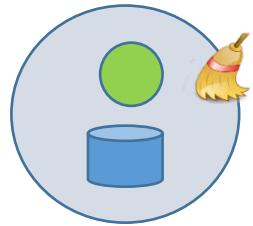


- Cells can be reprogrammed to become pluripotent

# ADITI Concept

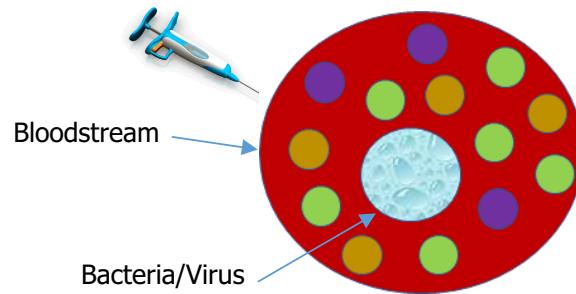
## Decentralized approach (inspired by nature - cellular theory)

### Cellular cleaning (autophagy)



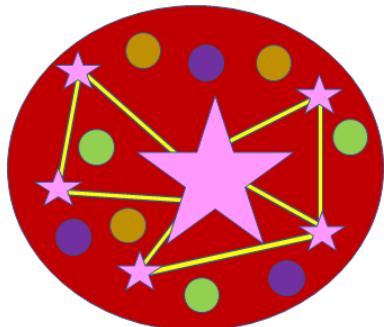
- Autophagy is a self-regulating mechanism of the cell to get rid of or renew defective or dysfunctional elements

### Protective mechanisms against bacteria/viruses



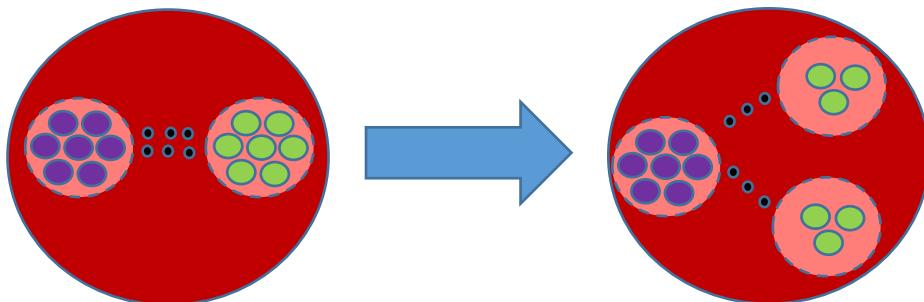
- Cells defend themselves from viruses, bacteria with some mechanisms

### Neuronal network



- The network of neurons provides a high response cellular communication

### Mechanisms of distribution of cellular workload



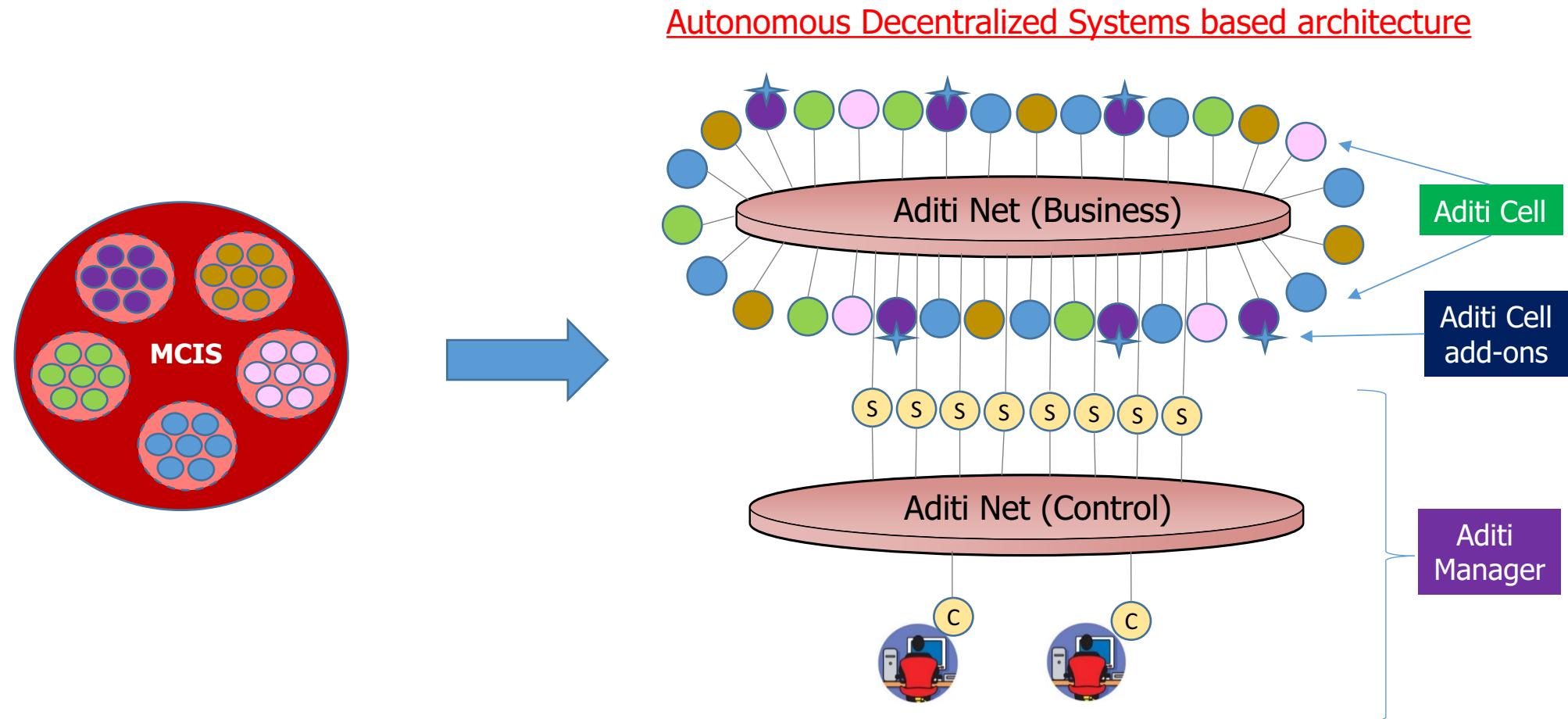
- Cells should have some mechanisms for cellular workload, although there is currently no evidence of this behavior

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# ADITI Architecture

ADITI is the ultimate platform for executing mission critical information systems



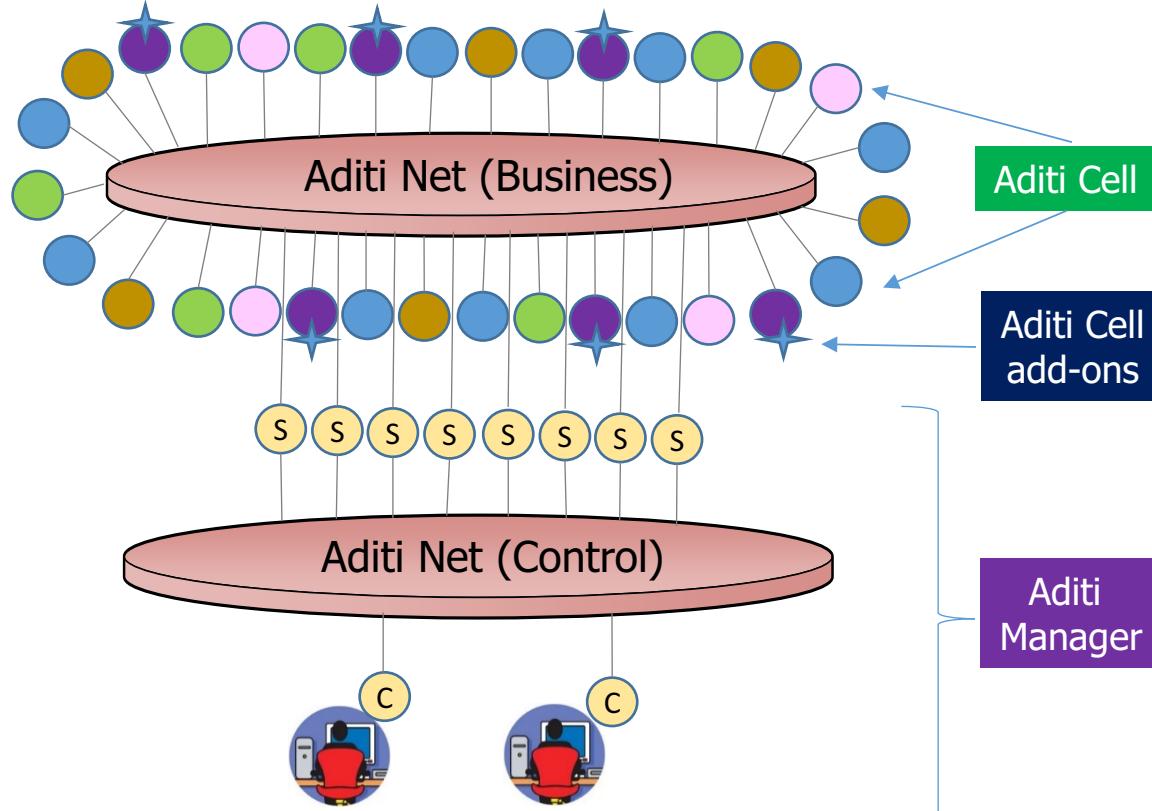
# ADITI Architecture



## ADITI - Net

*Autonomous Decentralized IT Infrastructure - Net*

ADITI-Net is the software infrastructure supporting sending and receiving messages between distributed applications developed with ADITI technology.



## ADITI - Cell

*Autonomous Decentralized IT Infrastructure - Cell*

ADITI-Cell is the software component that provides micro services functionality in applications developed with ADITI technology.



## ADITI - Manager

*Autonomous Decentralized IT Infrastructure - Manager*

ADITI-Manager is the component that allows controlling the ADITI platform.



## ADITI - Cell add ons

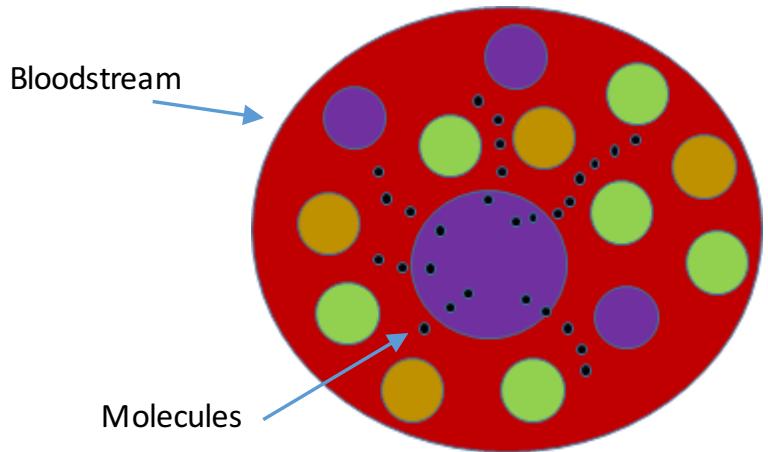
*Autonomous Decentralized IT Infrastructure - Cell add ons*

ADITI-Cell add-ons are a set of software components which allow to integrate different technologies, such as databases and web services, with ADITI technology.

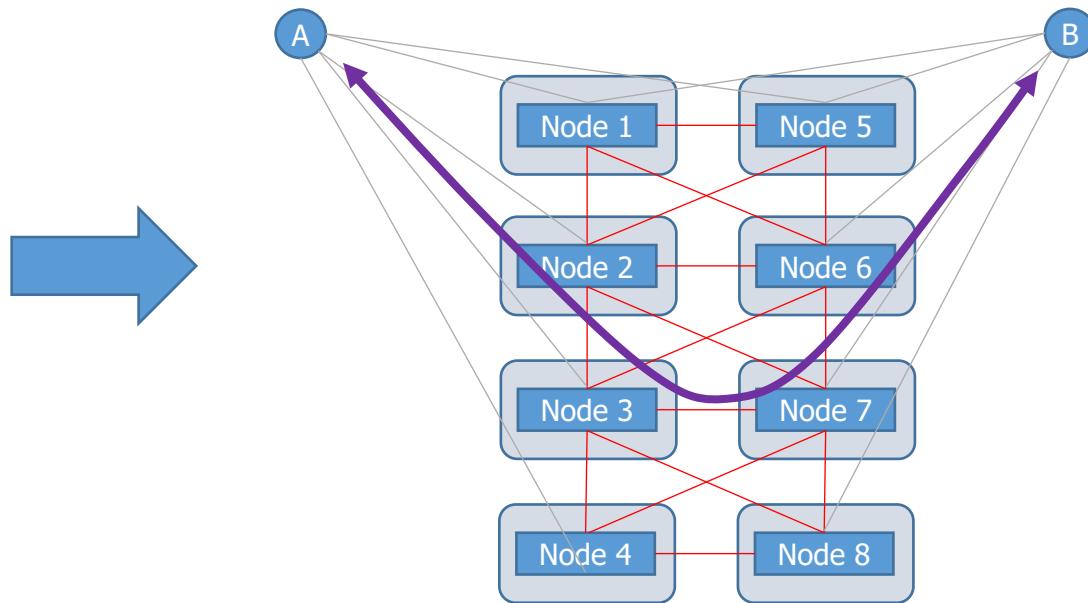
# ADITI-Net

ADITI-Net is the software infrastructure supporting sending and receiving messages among distributed applications developed with ADITI technology.

## Inspired by endocrine communication



- Messages are transmitted through molecules poured into the bloodstream.
- Molecules circulate throughout the body, being taken only by the cells that must receive the message



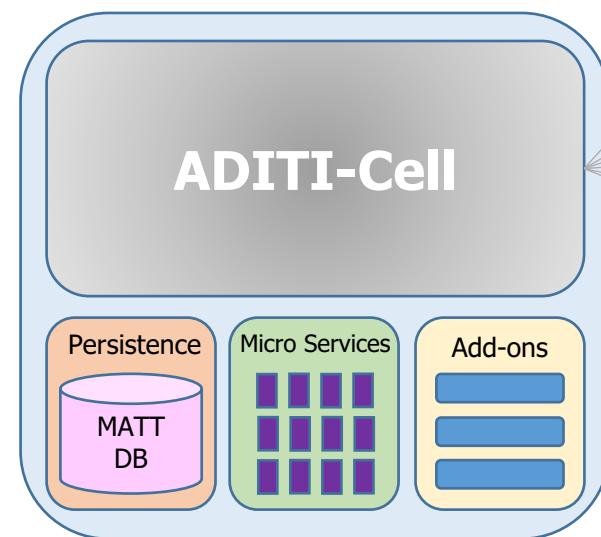
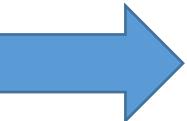
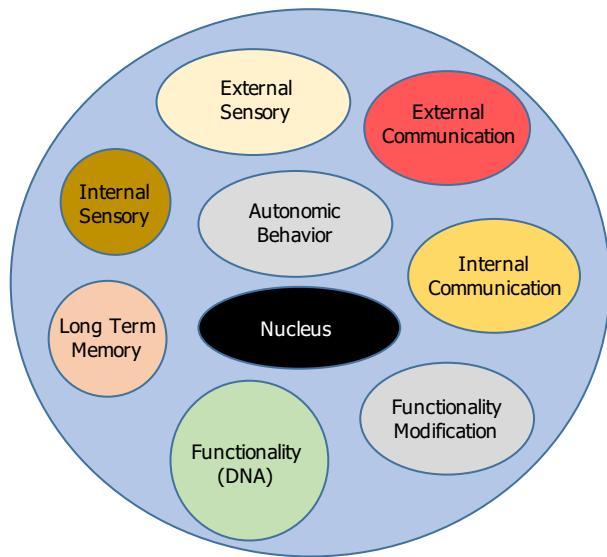
- High Reliability
- High Availability
- Content code communication
- High elasticity
- Timeliness communication (2 steps)
- Secure authentication (3 mechanisms)



# ADITI-Cell

ADITI-Cell is the software component that provides micro services functionality in applications developed with ADITI technology.

## Inspired by cells



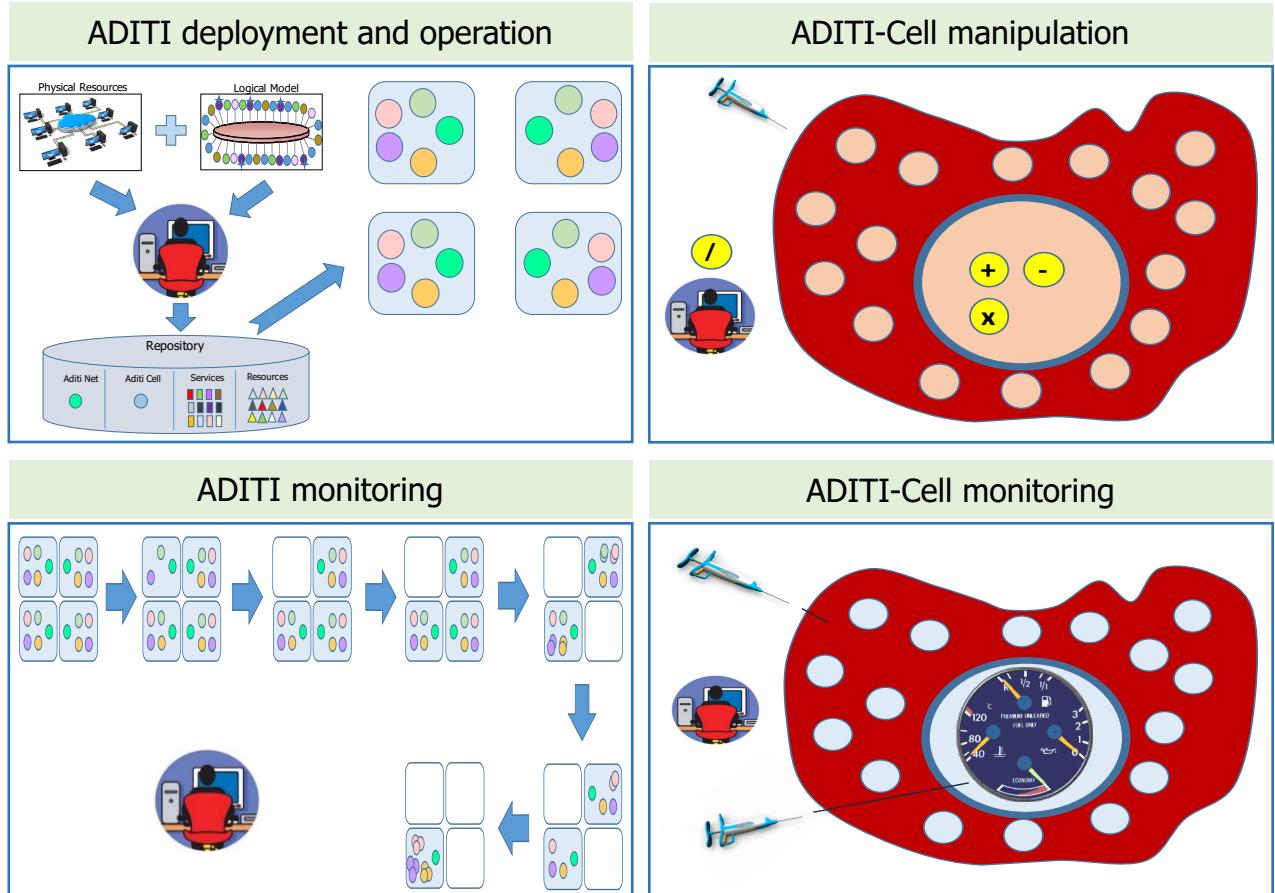
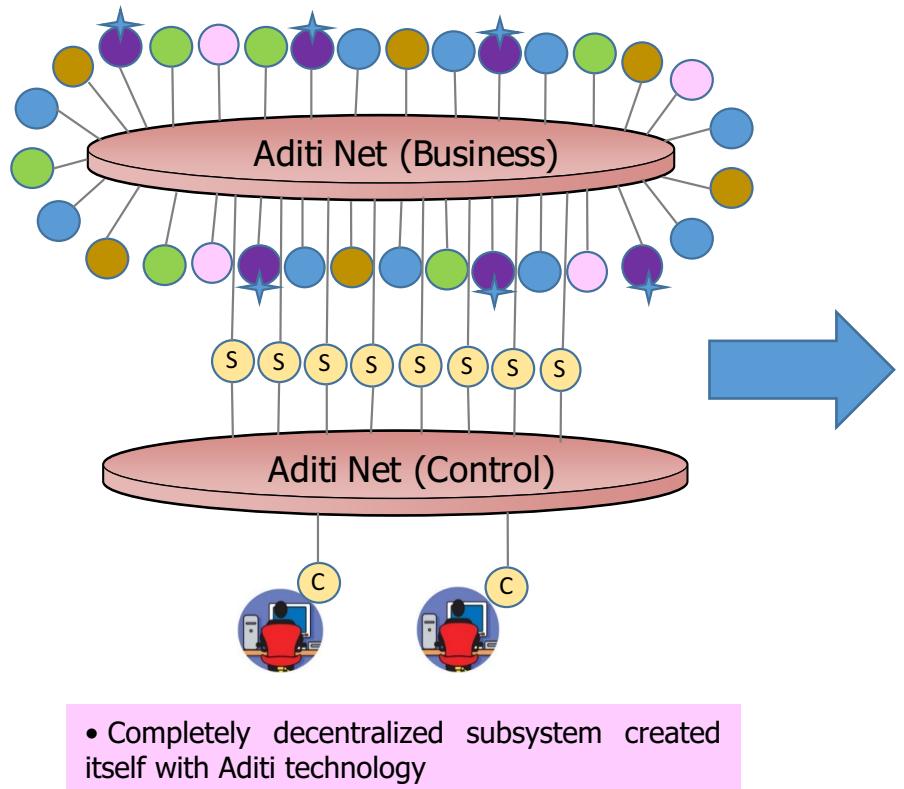
- The functionality of an ADITI application takes place in the ADITI-Cell core
- The internal logic of each micro service is implemented into the DNA of the component.

- High performance
- High functional availability
- Online maintenance
- Maximum efficiency in the use of computational resources
- Parallel execution of micro services inside cell components
- Transactional handling of the data persistence
- Selective security mechanisms
- Integration with other technologies



# ADITI-Manager

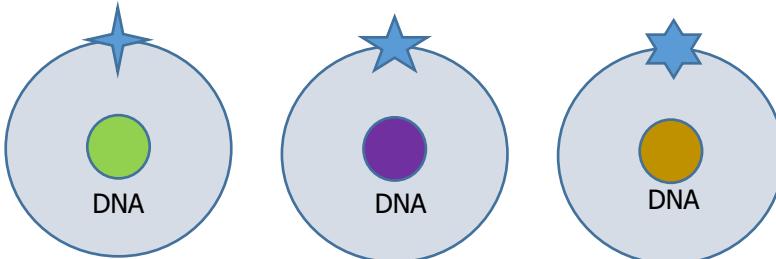
ADITI-Manager is the component that allows controlling the ADITI platform.



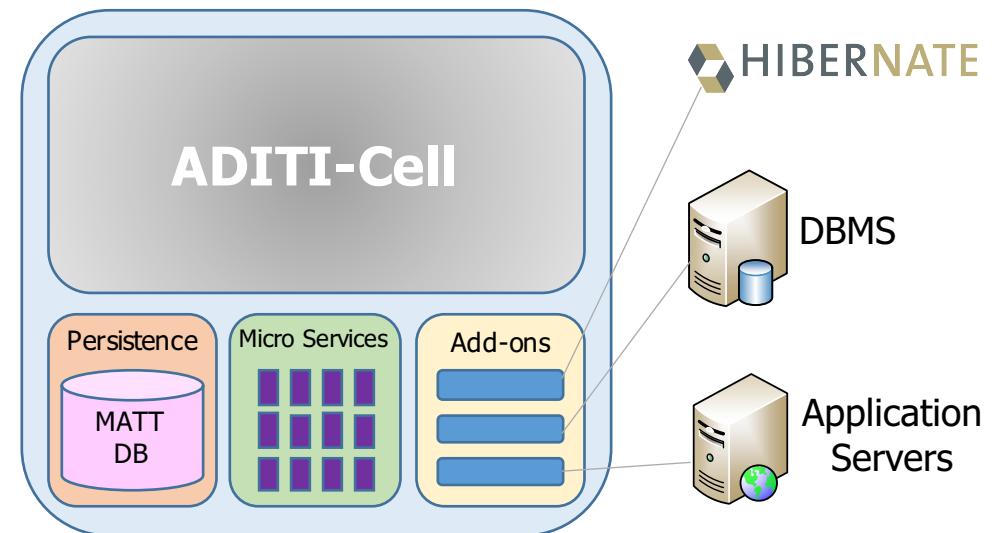
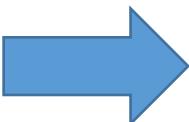
# ADITI-Cell add-ons

ADITI-Cell add-ons are a set of software components which allow to integrate different technologies, such as databases and web services, with ADITI technology.

Inspired by cell's external sensory



- Some cells have to interact with external elements.



- Integration with main technologies used in the industry.
- Compatibility assured with ADITI.
- Time saving during the development of ADITI applications.

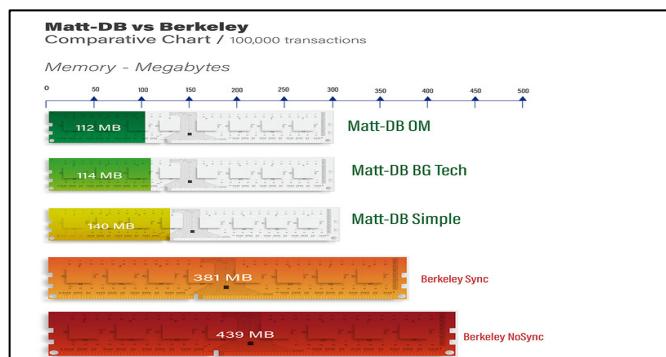
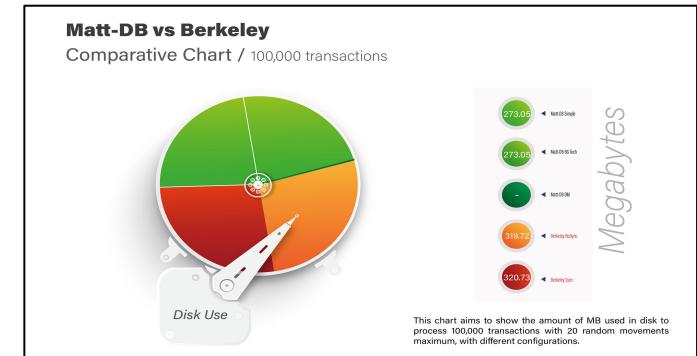
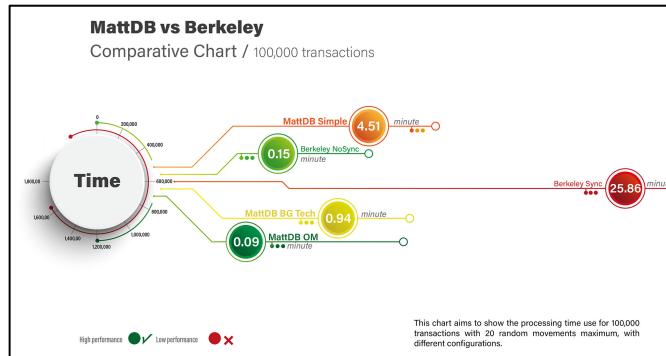
# Matt-DB

Matt-DB is an embedded object-oriented database manager. It supports ACID transactions and achieves high performance. Matt-DB was designed for information systems that require critical response times in the execution of transactions, nearly memory speeds.

## Features

- Database model programming in a few steps
- Background transaction technology to improve performance
- Thread-safe transactions
- Only-in-memory-operation option
- Database locking at object/ register level
- Disk and memory optimization
- Minimum time for fault recovery
- High availability replication
- Snapshot backups

## Matt-DB vs Berkeley-DB (Oracle)



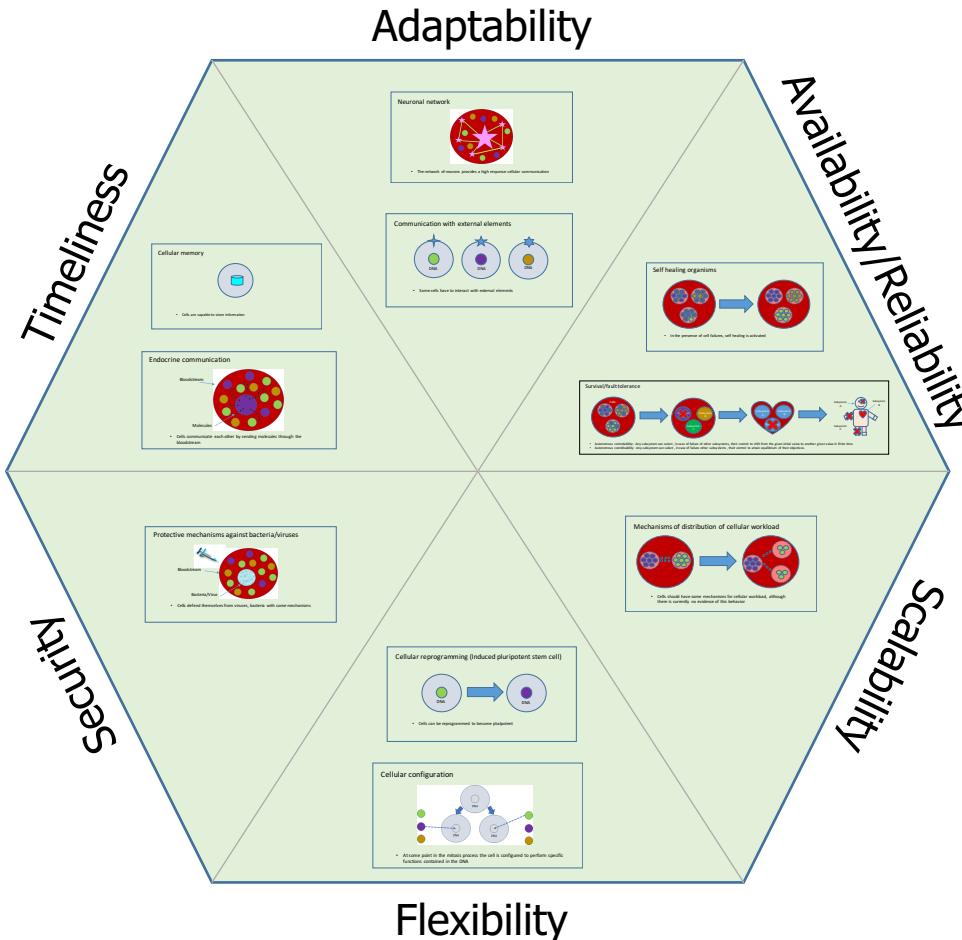
For the comparative test between Matt-DB and Berkeley-DB, a database model consisting of 20 tables was used, with randomly selected attributes, such as Strings, Integers, Lengths, Characters, Bytes and Byte arrays. The test consisted of the execution of 100,000 transactions consisting of 1 to 20 random operations (read, delete or write) in the 20 tables of the model.

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# ADITI Technologies

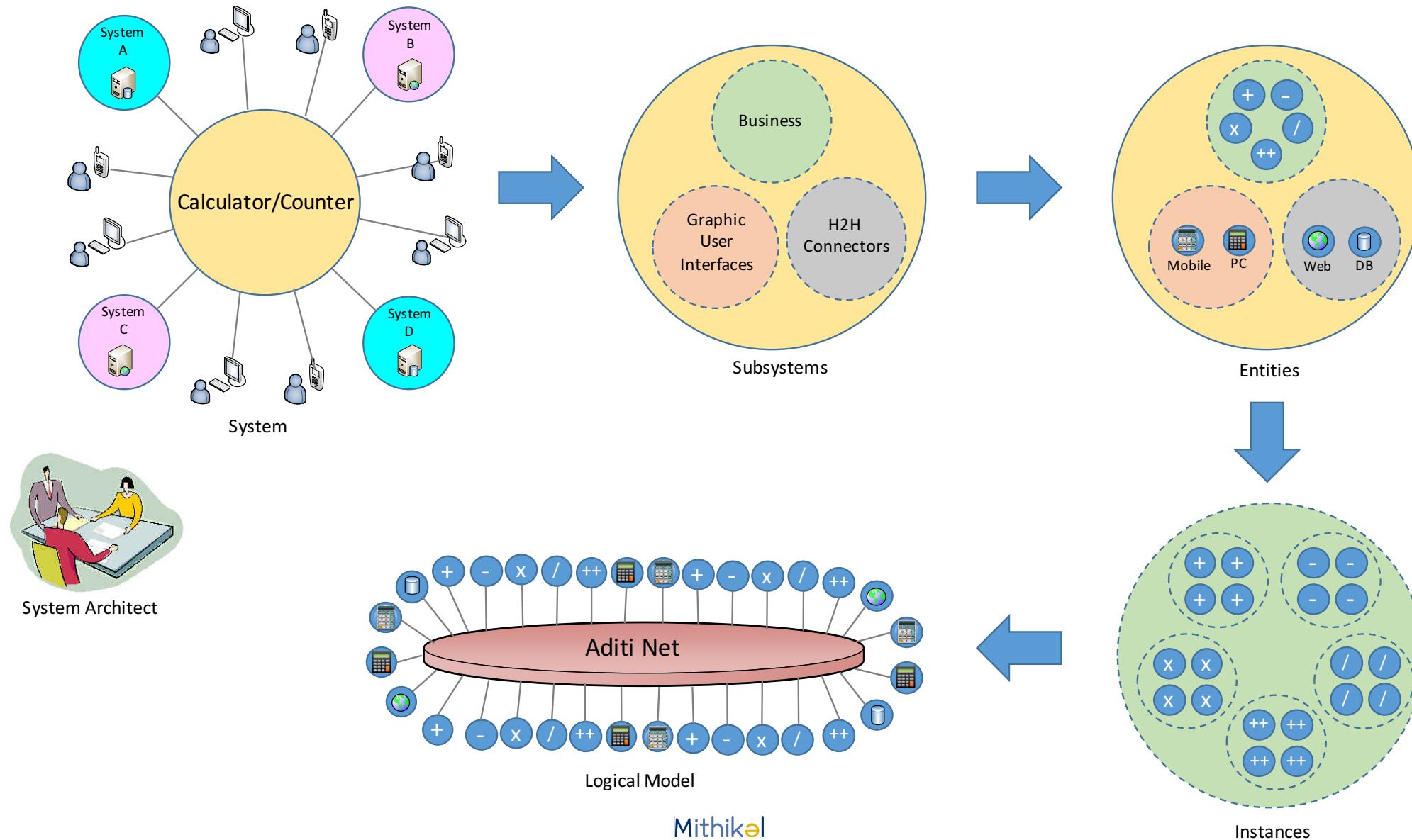
A diversity of technologies have been implemented on ADITI components



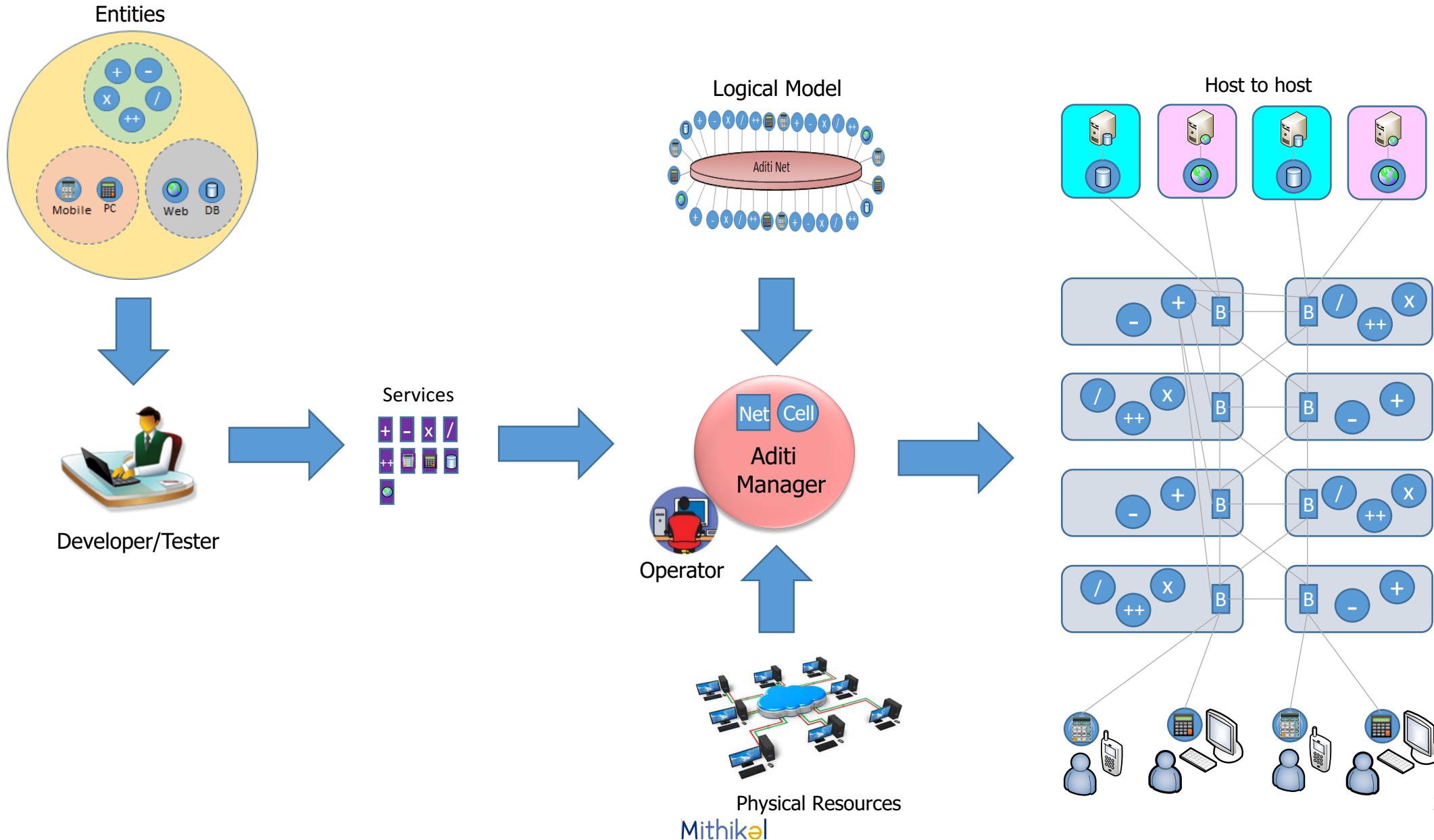
## ADITI Components

- Aditi Net
- Aditi Cell
- Aditi Manager
- Aditi Cell add-ons

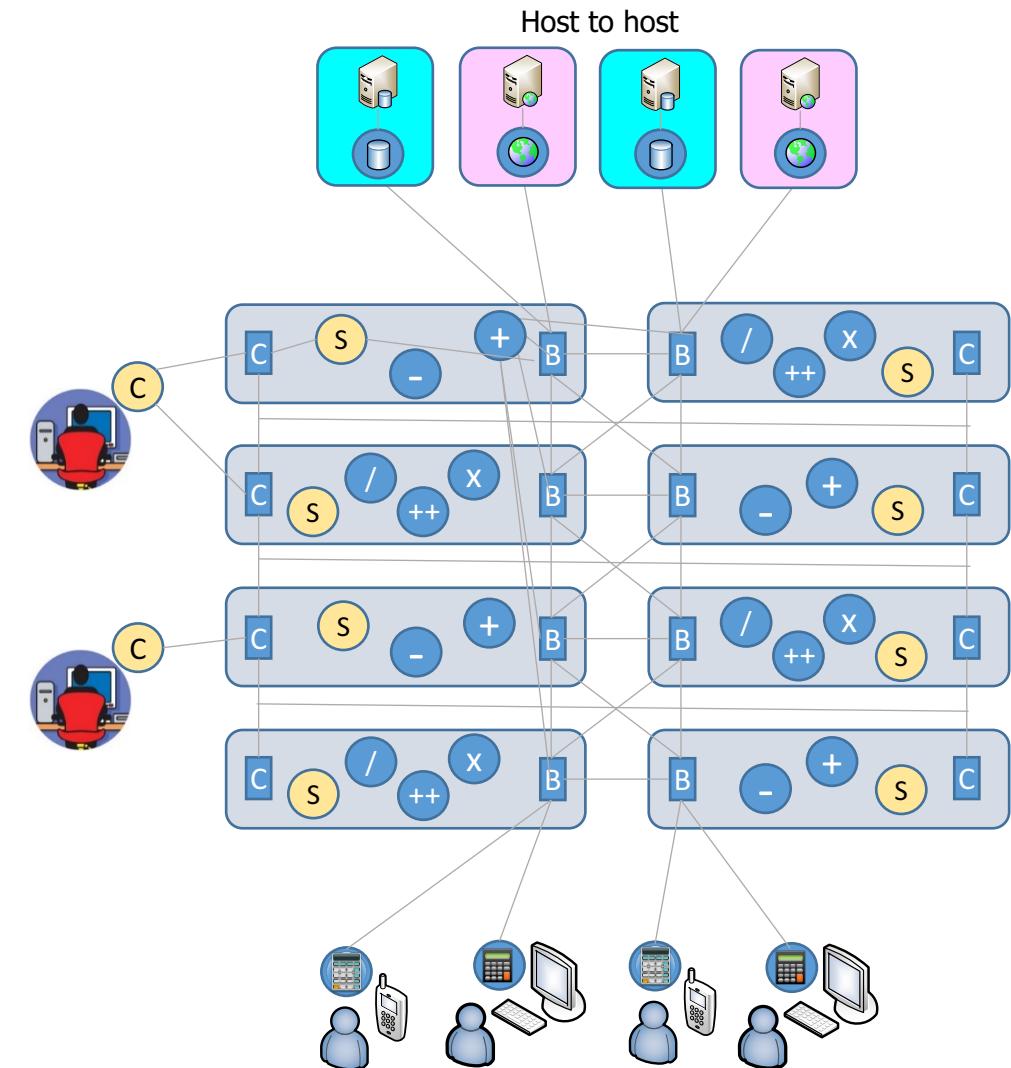
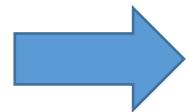
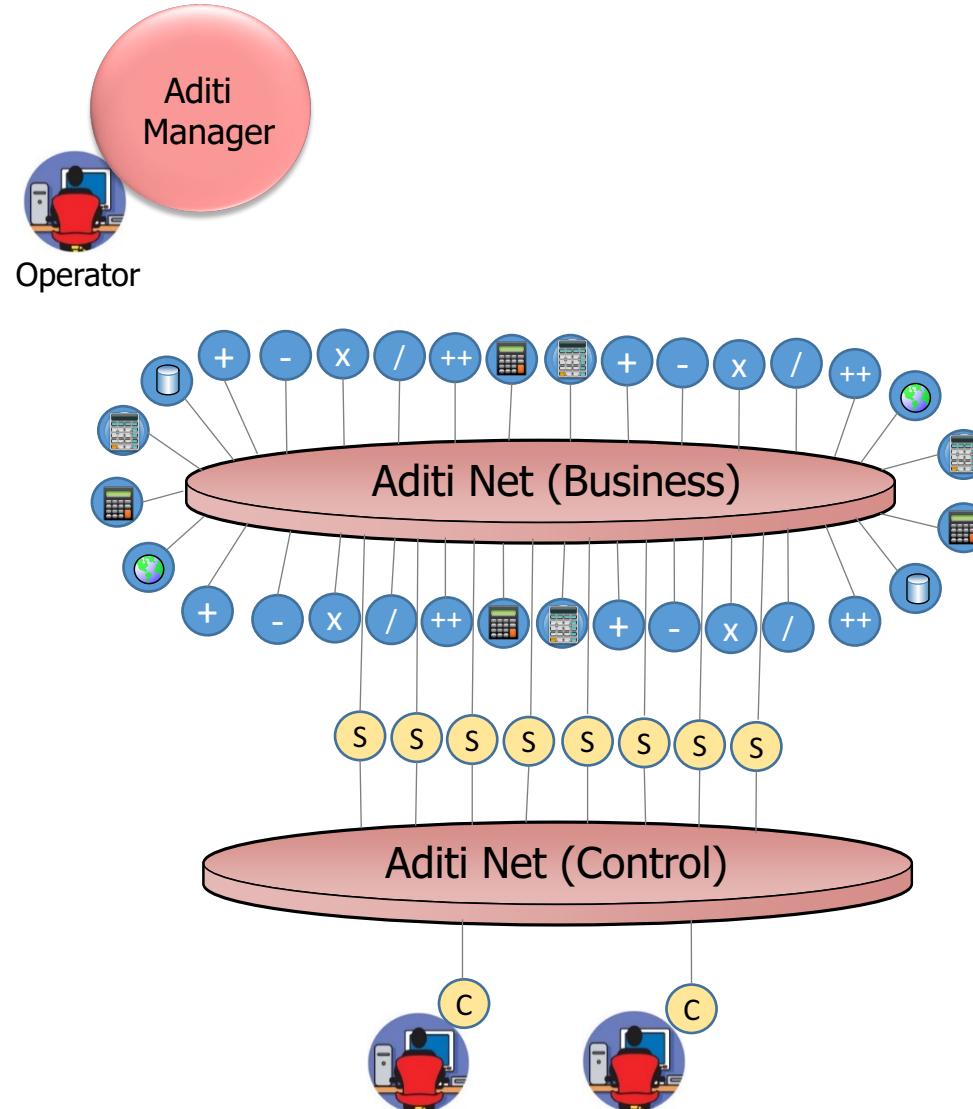
# Designing and Implementing a MCIS in ADITI



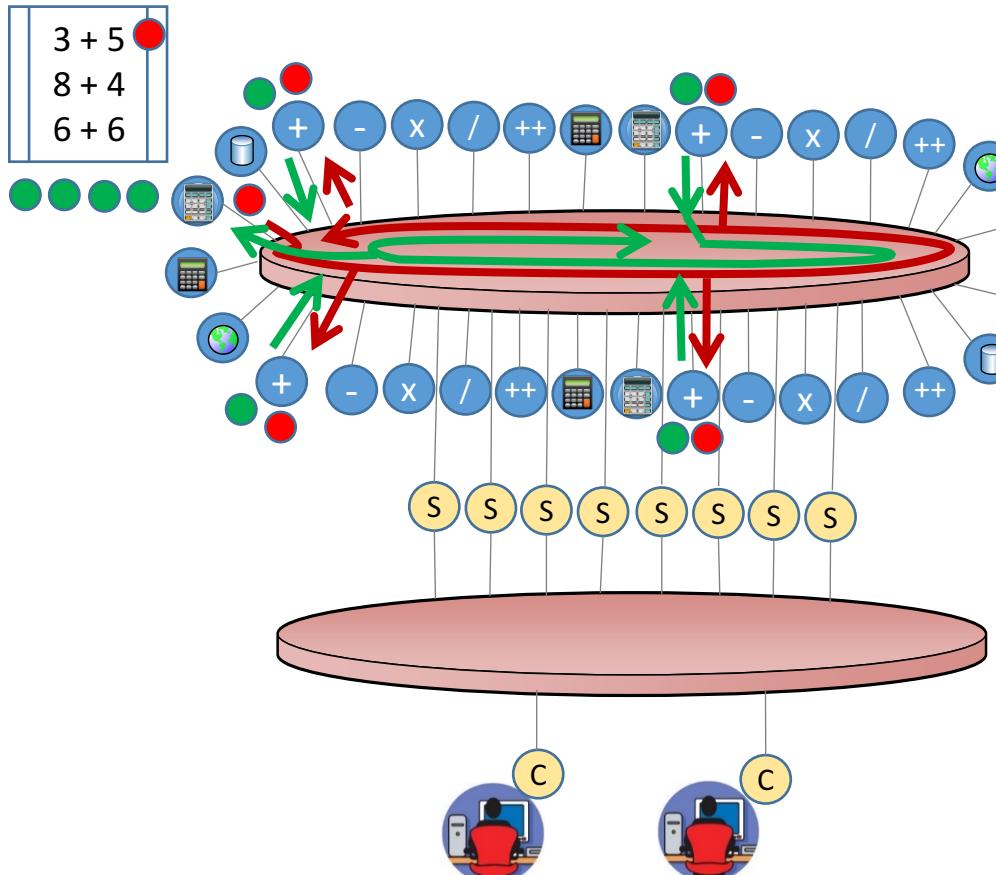
# Designing and Implementing a MCIS in ADITI



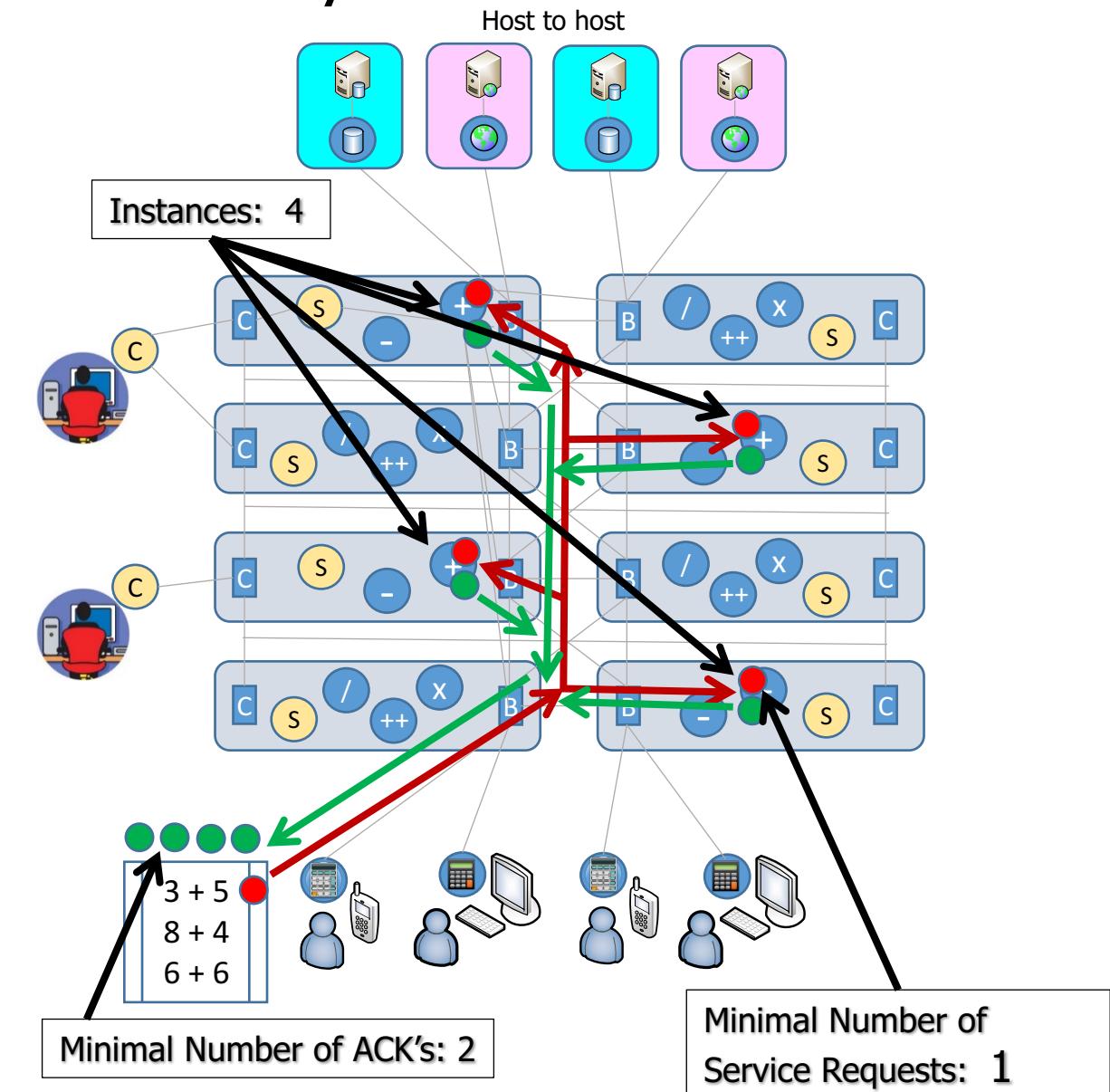
# Designing and Implementing a MCIS in ADITI



# Autonomous Controllability and Coordinability Technology

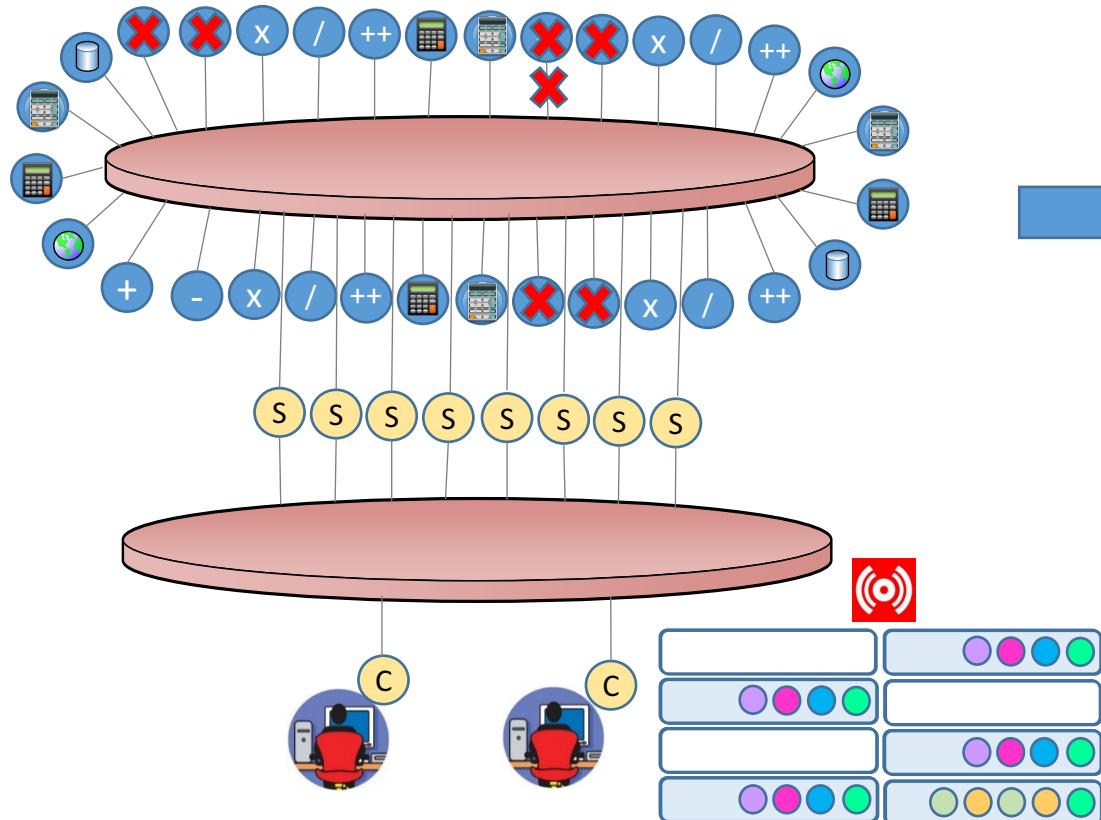


The system has to continue working even in the presence of some failures.

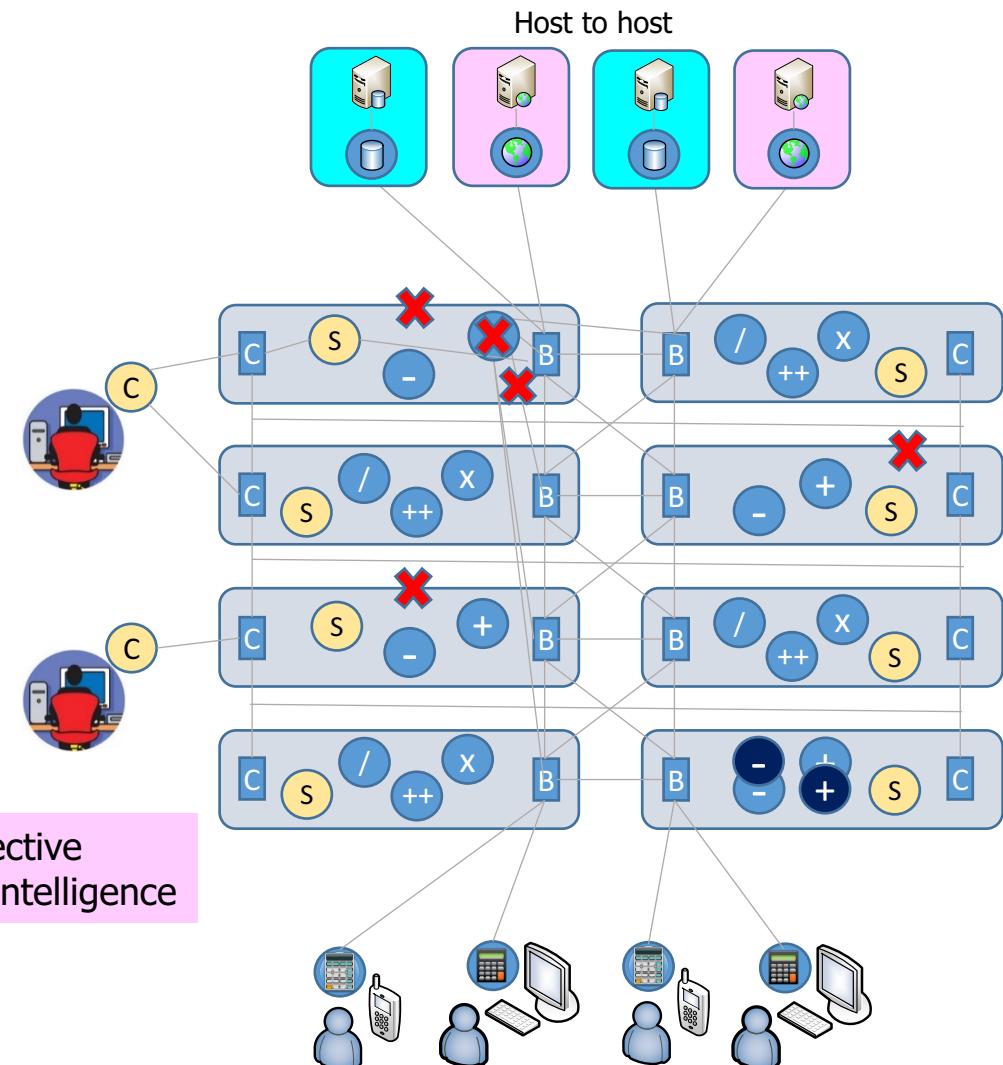


# Autonomous Recovery Technology

The system recovers itself when due to failures it has reached the minimum level of surviving.



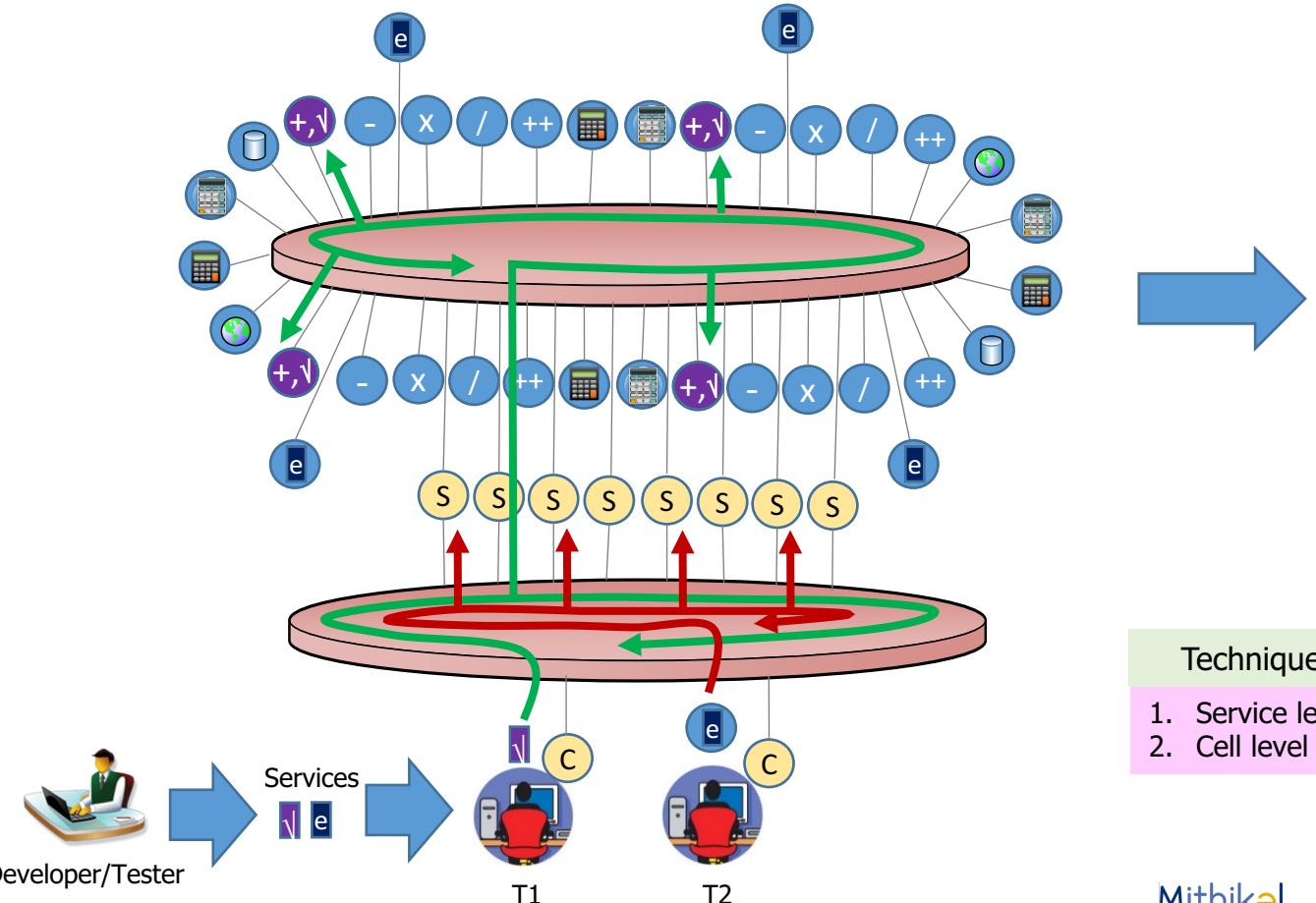
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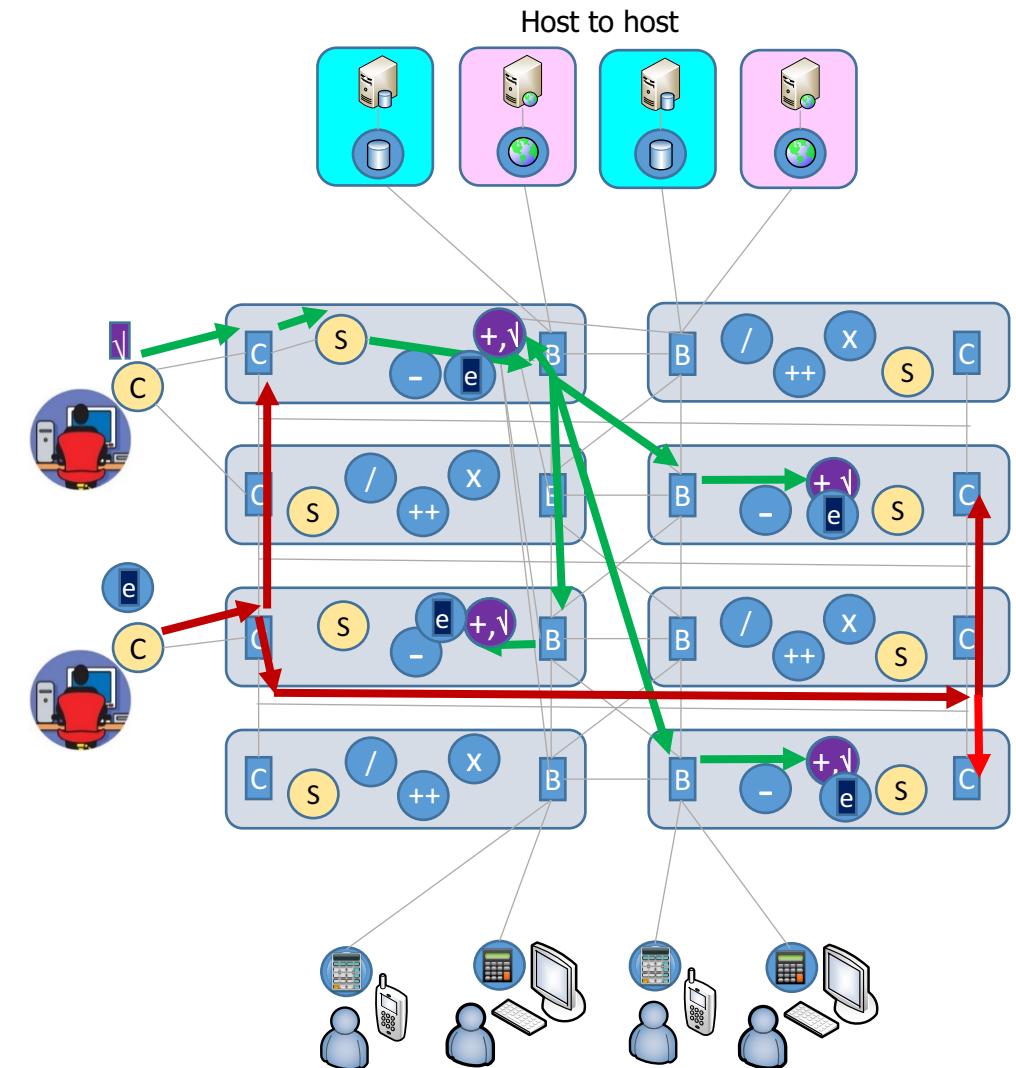
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# On-line Services Maintenance Technology

Services have to be maintained without stopping any part of the system.

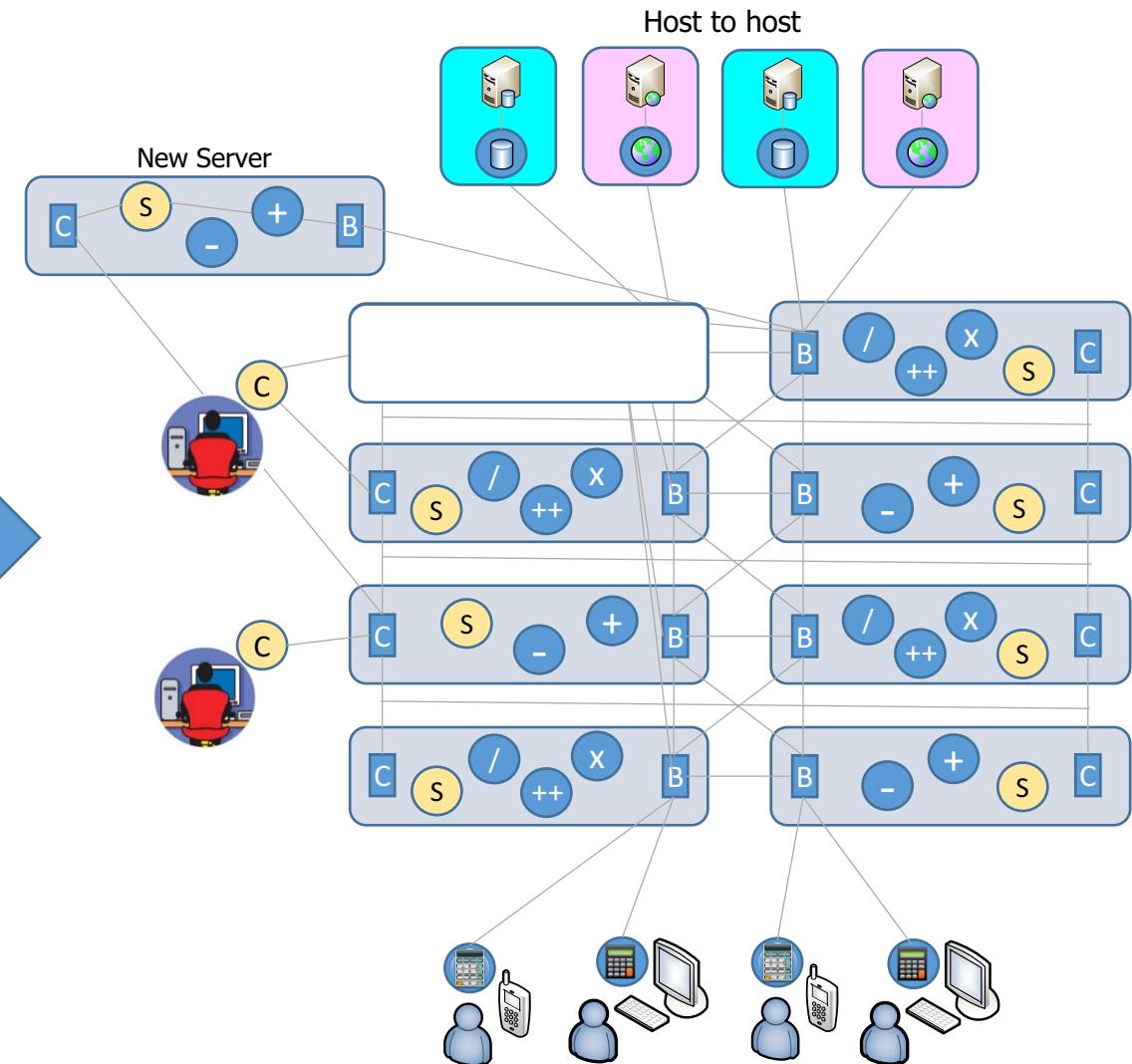
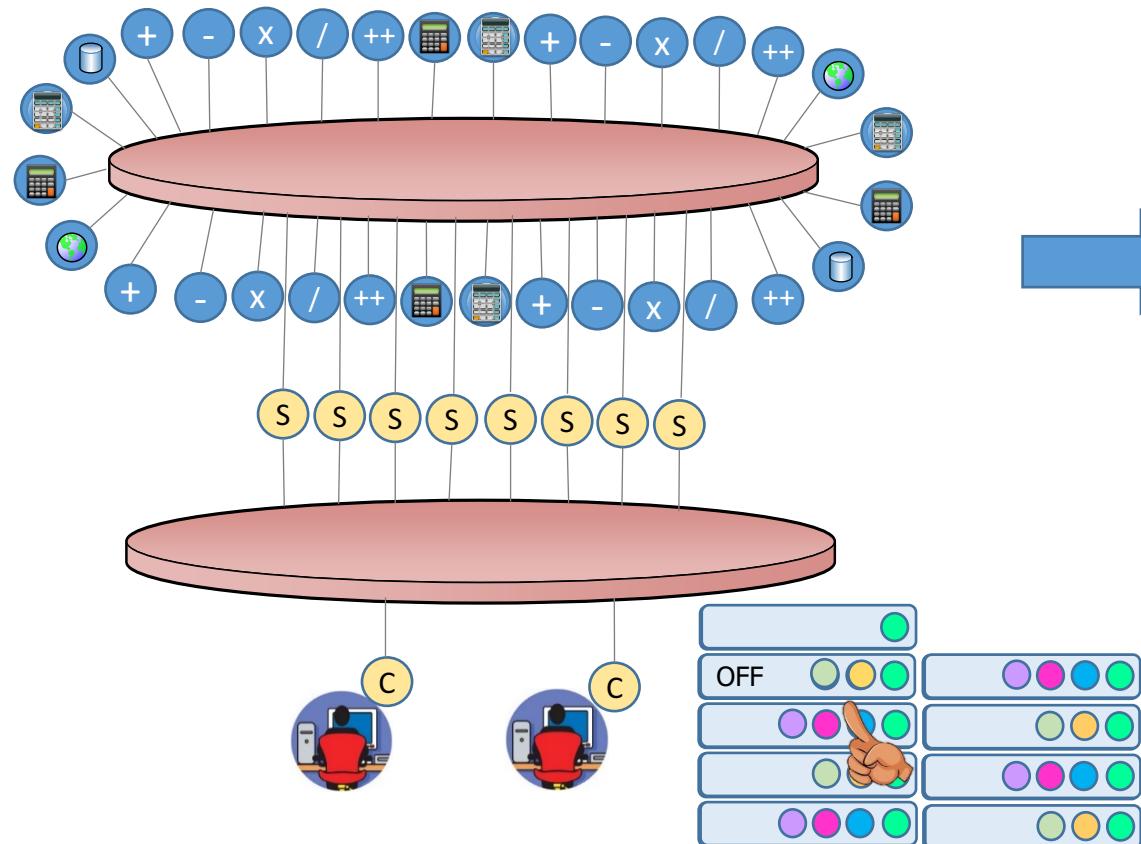


- ## Techniques



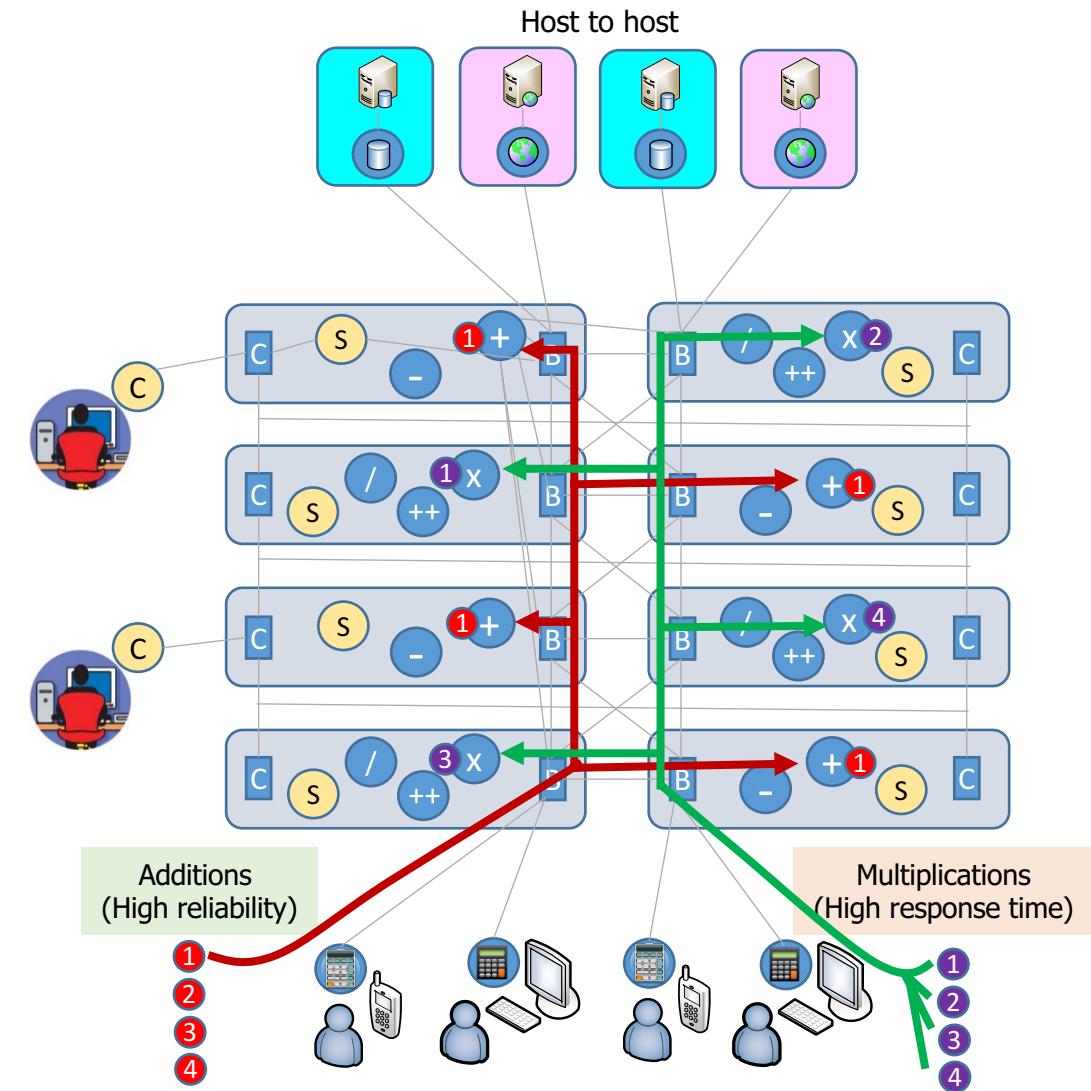
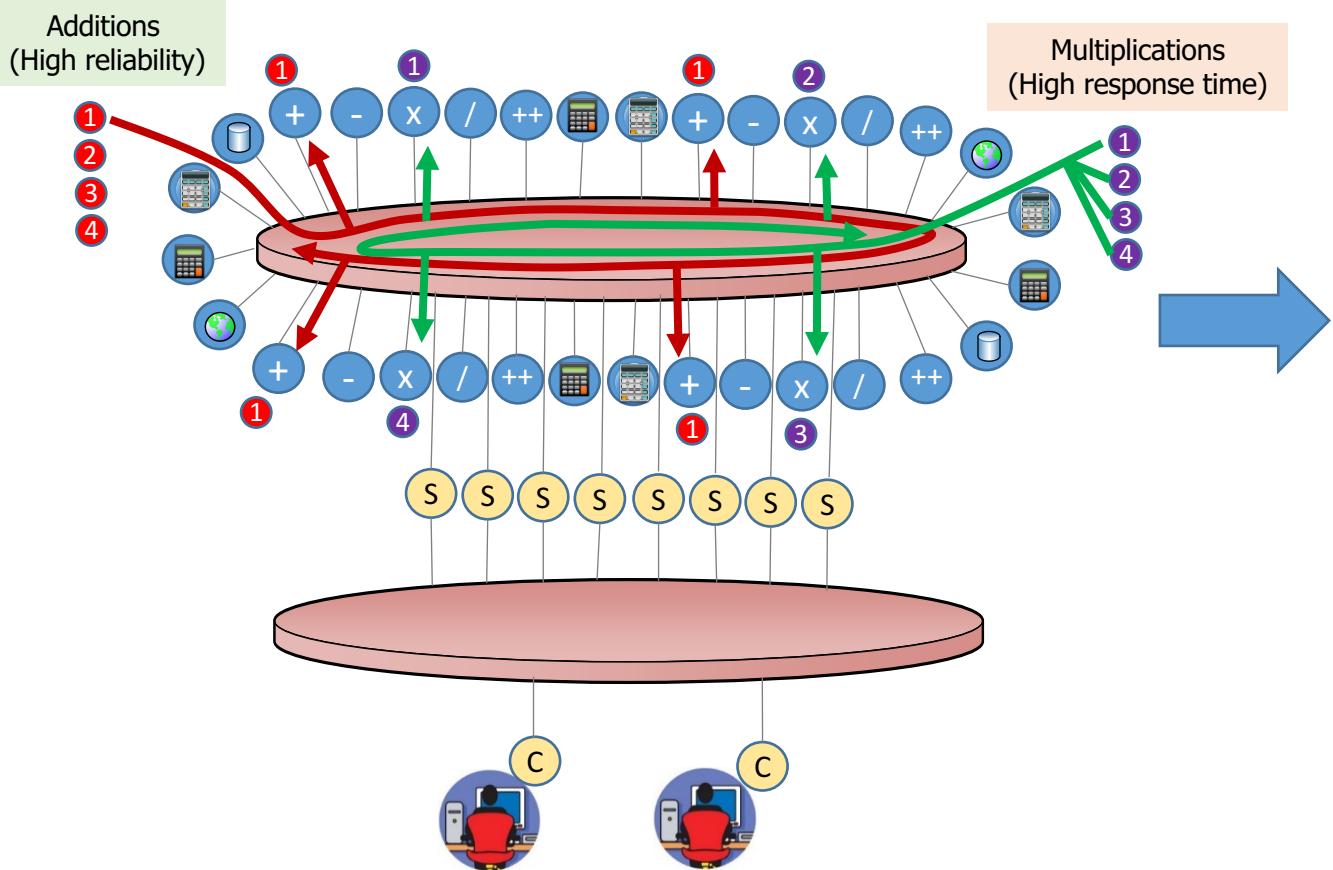
# On-line Migration Technology

System migration has to be done without stopping any part of the system



# Dynamic Workload Distribution Technology

The system has to distribute dynamically the workload when the situation allows it for timeliness.



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# Applications

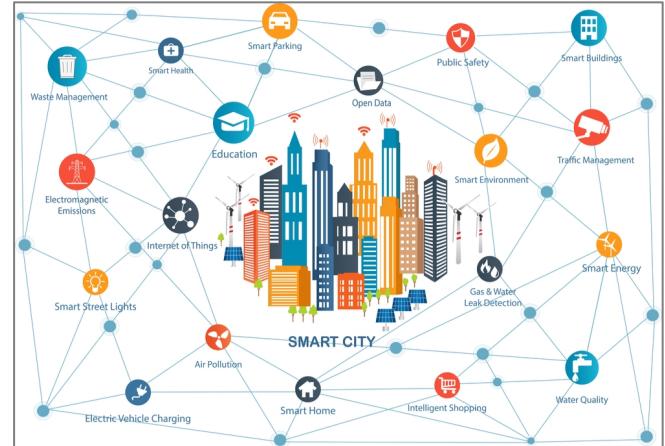
Banking Systems



E-Commerce



Smart Cities



## E-PAYMENT

Application, E-wallet, QR Code, Credit card, Digital Money, Online Banking, NFC, Blockchain

## SMART GRID

Solar Power, Thermal Power, Factories, Hydroelectric Power, Electric Vehicle, Smart Home, Wind Power

## INDUSTRIAL 4.0

Automation, Big Data, Cloud computing, Autonomous, IOT, Data Management

# Final Remarks

More than 15 years of experience in the design, development and operation of critical information systems for financial markets



Autonomous Decentralized IT Infrastructure (ADITI)



<https://www.mithikel.com>

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