An Architectural Approach for Improving Availability in Web Services

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- Motivation
- Architectural pattern
- Implementation and results
- Concluding and future work

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Motivation

- Dependable systems that are built from existing components/systems/services;
  - existing systems cannot be trusted, they are not under the control of the architect;
  - the system has to be protected against faults;
- A good architecture improves the handling of faults:
  - error confinement, and reduction of system complexity;
- Application of traditional fault tolerant techniques:
  - Components – self-checking and comparison for error detection and confinement ;
  - System – system dynamic reconfiguration for fault handling;

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Motivation

- Not quite ‘Web services’:
  - HTML and text, but we are getting there;

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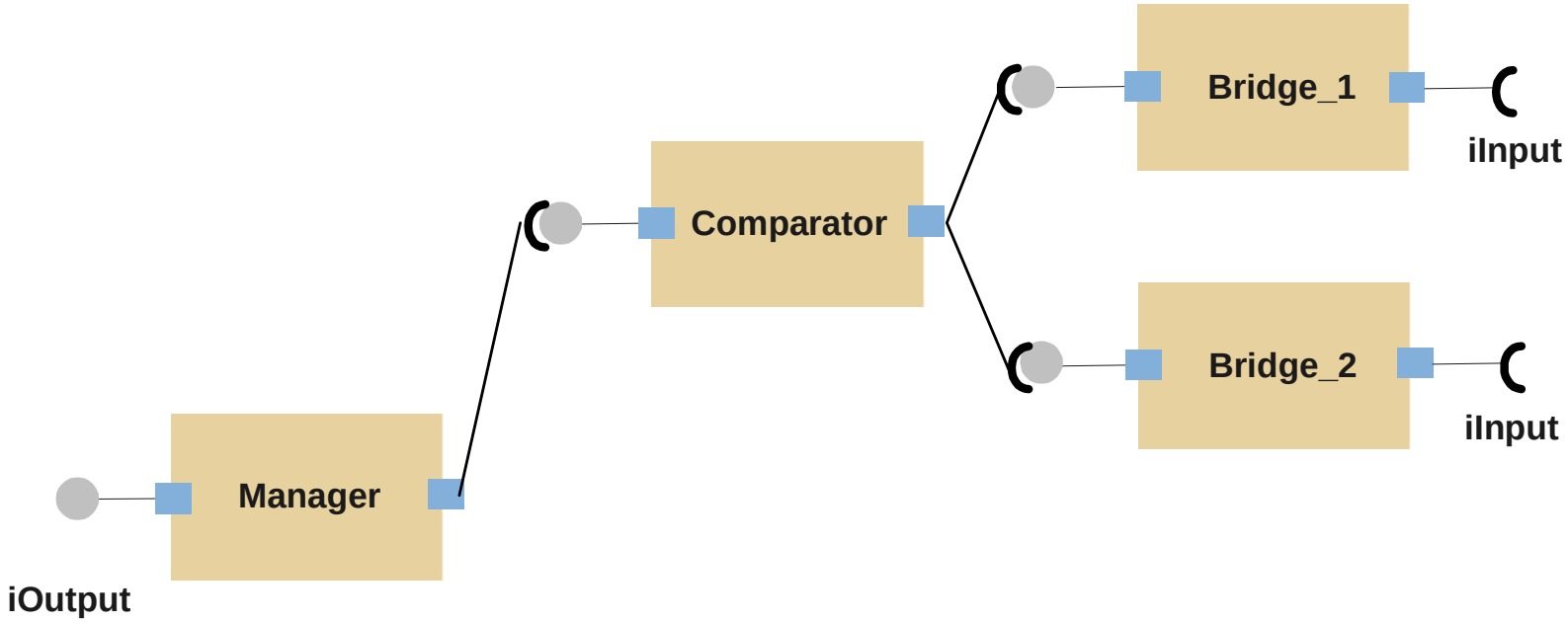
Architectural Solution

For improving the *reliability* and *availability* of systems by using multiple sources of information:

- Components implement crash-failure semantics;
  - plus timing self-checks;
- System dynamic reconfiguration;

Architectural Solution



Failure assumptions:

- Bridge: arbitrary failures;
- Comparator: crash-failures;
  - *n* failures for *n+1* Bridges;
- Manager: does not fail;

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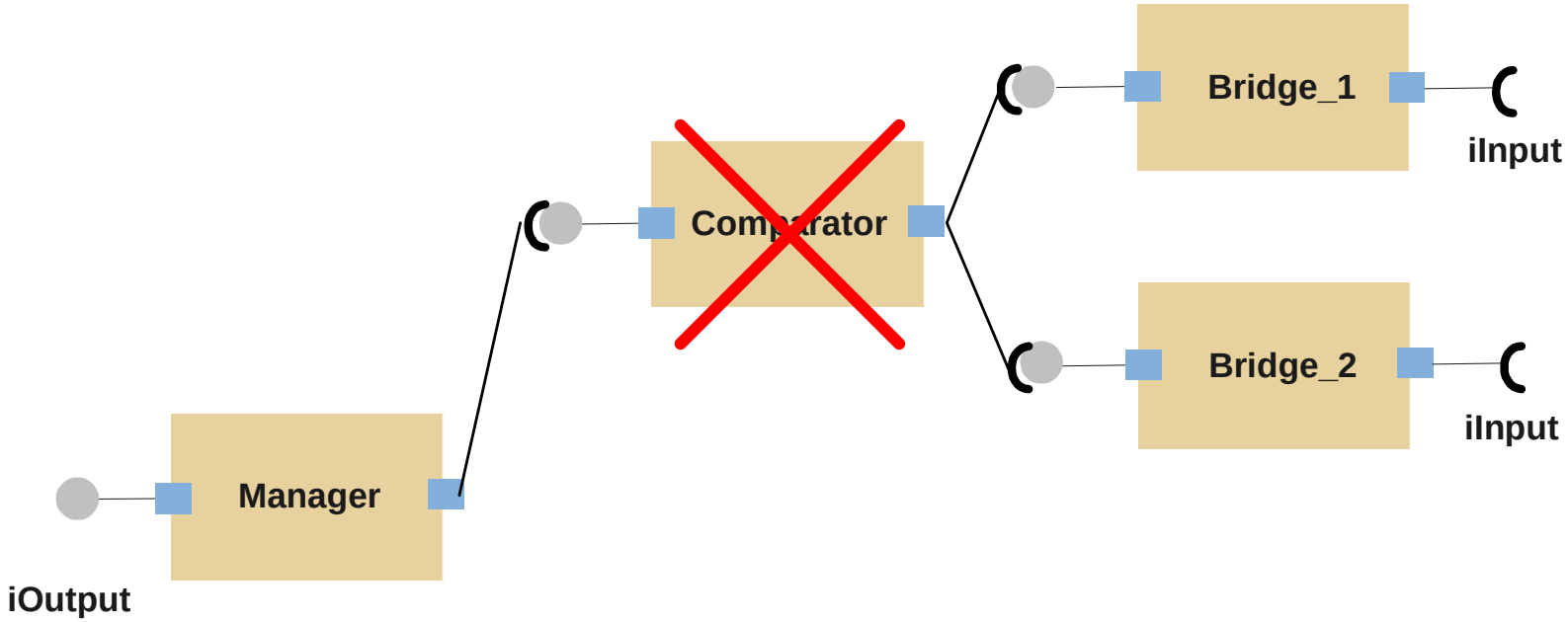
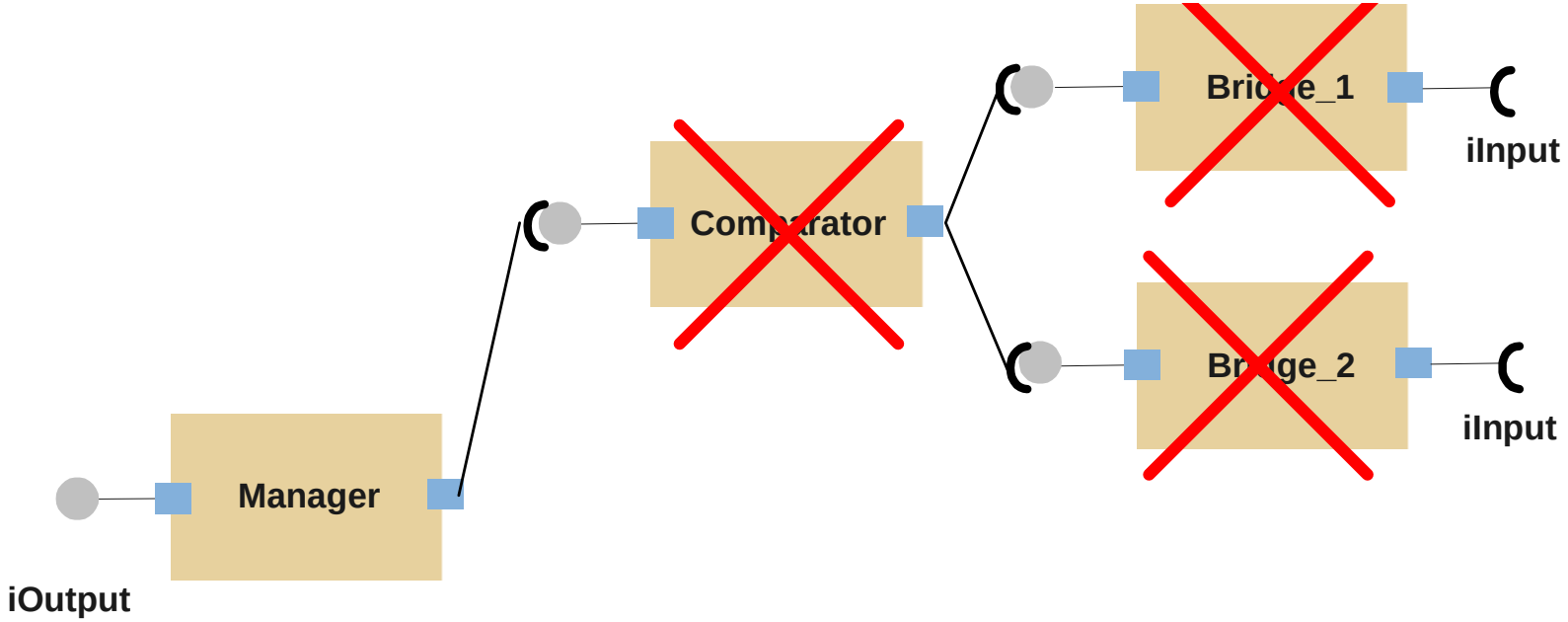
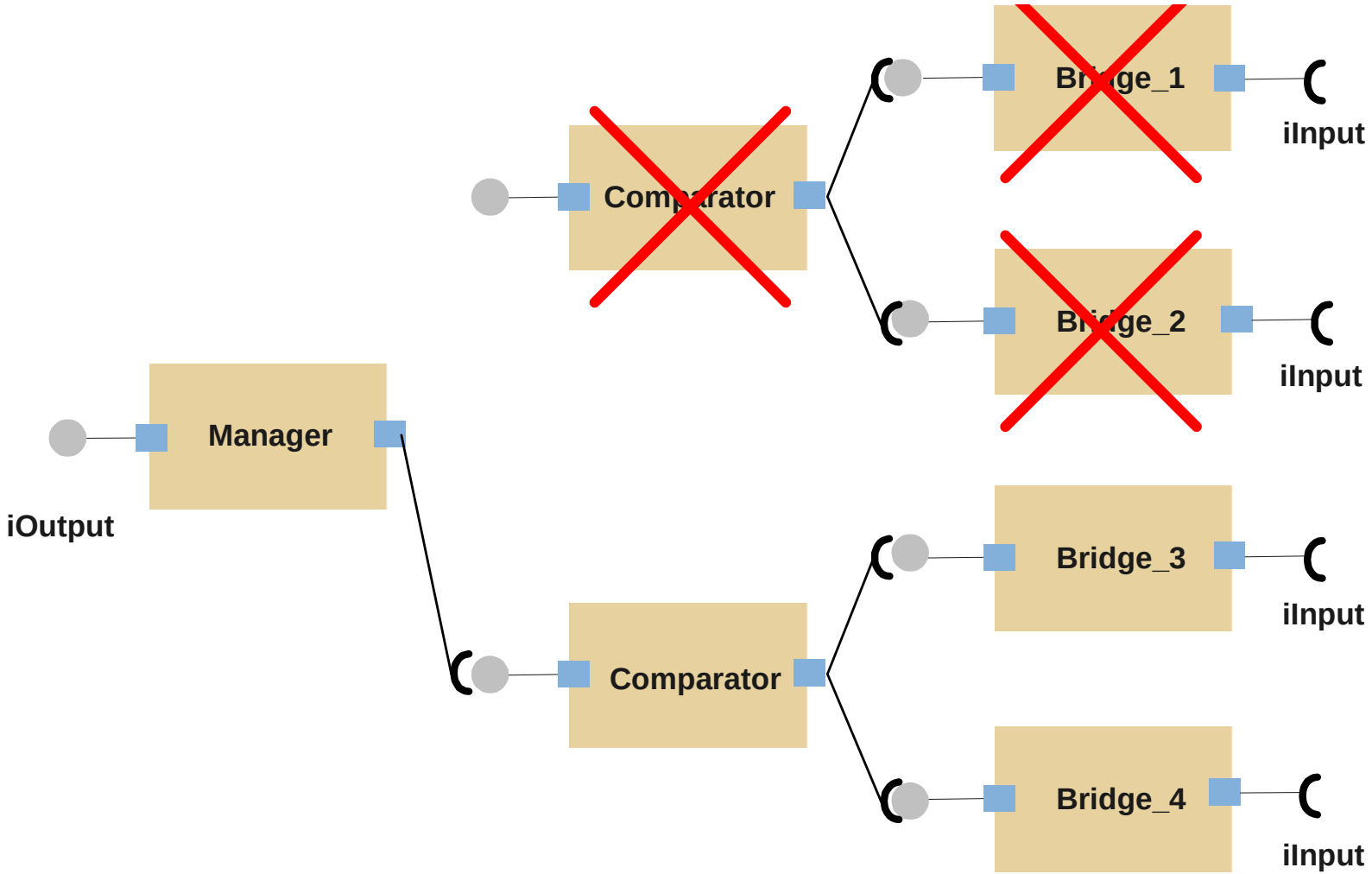
Architectural Solution



Architectural Solution

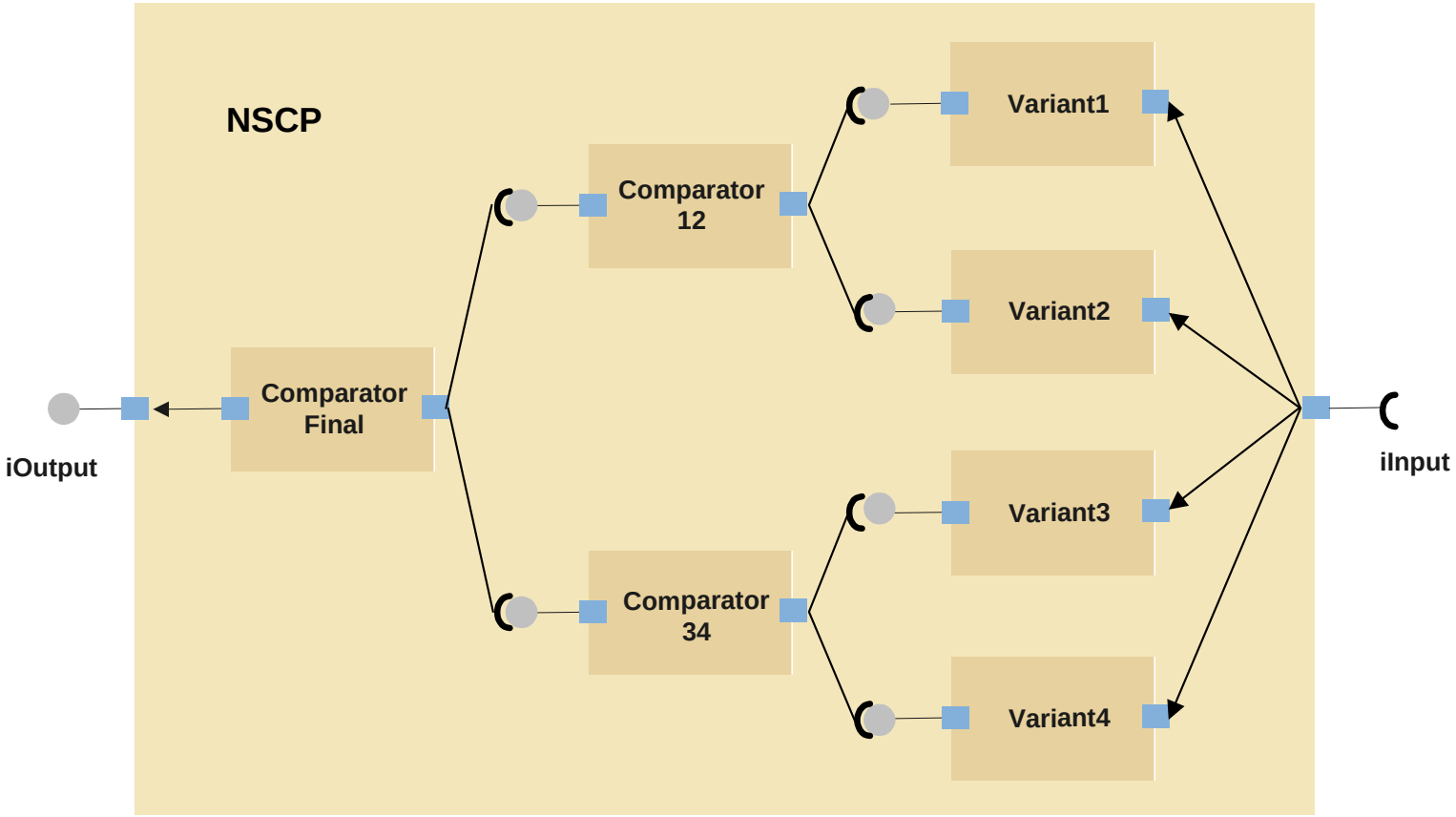


Architectural Solution



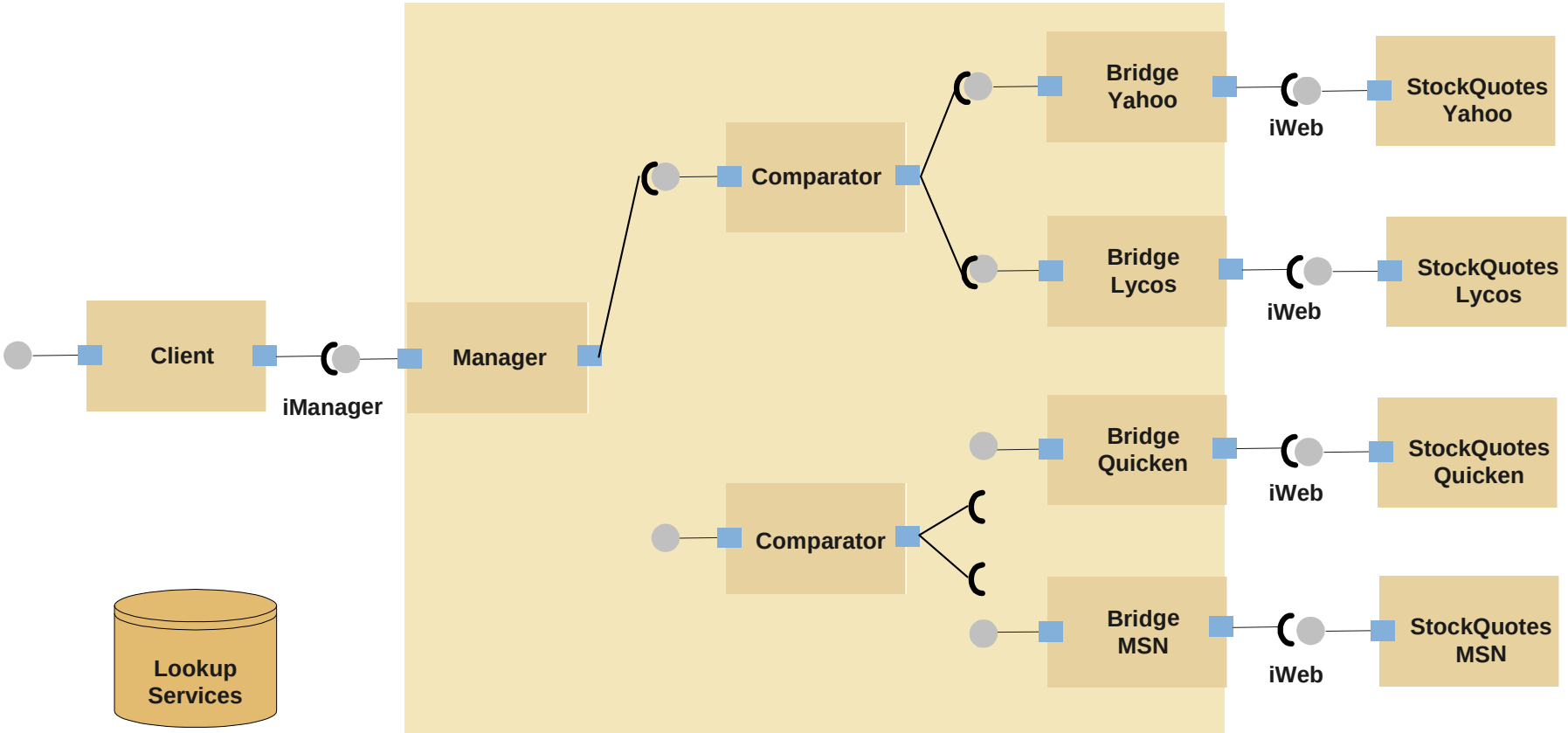
N Self-Checking Programming

NSCP is a design diverse technique that uses redundancies to check its own behaviour during execution.



Case Study: Stock Quotes

Implemented in *Jini*: set of APIs and network protocols that help in building and deploying distributed systems;



Implementation Analysis

System statistics:
total restoration time (ms)

	Average time (ms)
Failure detection	80
Reconfiguration	2
Stream restoration	123
Total restoration	205

Reliability and availability of the services and final system

	Reliability (failure rate)	*Availability*
Yahoo	4.2 f/p	0.999
Lycos	81.3 f/p	0.983
Quicken	8.4 f/p	0.998
MSN	6.9 f/p	0.998
System Service	0.6 f/p	0.999

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Concluding Remarks

- Architectural solution for improving the reliability and availability of Web services:
  - it might be naïve but it does the job;
    - its feasibility was shown in the context of stock quote information;
- Current and future work:
  - apply the architectural solution in the context of Web services;
  - special attention will be given to the Bridge component for the purpose of fault tolerance:
    - addition of the non-functional interface;
    - automatic generation of an implementation;