

# Co-allocation, Fault Tolerance and Grid Computing

*Mark Mc Keown*  
*Manchester Computing*

# Introduction

- There are no original ideas in this paper - algorithms by Jim Gray & Leslie Lamport, architecture by Roy Fielding.
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- Grid Computing & Fault Tolerance.
- Co-allocation.
- SOAP or REST?
- HARC – Highly Available Robust Co-allocator.

# Grid Computing

- “...large scale, or internet scale, distributed computing...”
  - **A Grid will always have faults.**
- “...crossing organizational boundaries...”
  - **Some faults will be Byzantine.**
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- “A distributed system is one in which the failure of a computer you didn’t even know existed can render your own computer unusable” - Lamport



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- Reliability impacts on Usability
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- If you cannot be reliable, then be predictable.

# Co-allocation

- Co-allocation is the provision of a set of resources at the same time or at some coordinated set of times.
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- Co-allocation can be achieved by making a set of reservations for the required resources with the respective resource providers.

# Approaches to Co-allocation

- One Phase Solution.
  - Users may be charged for cancelling reservations.
- Two Phase Solution.
  - Not fault tolerant - blocking.

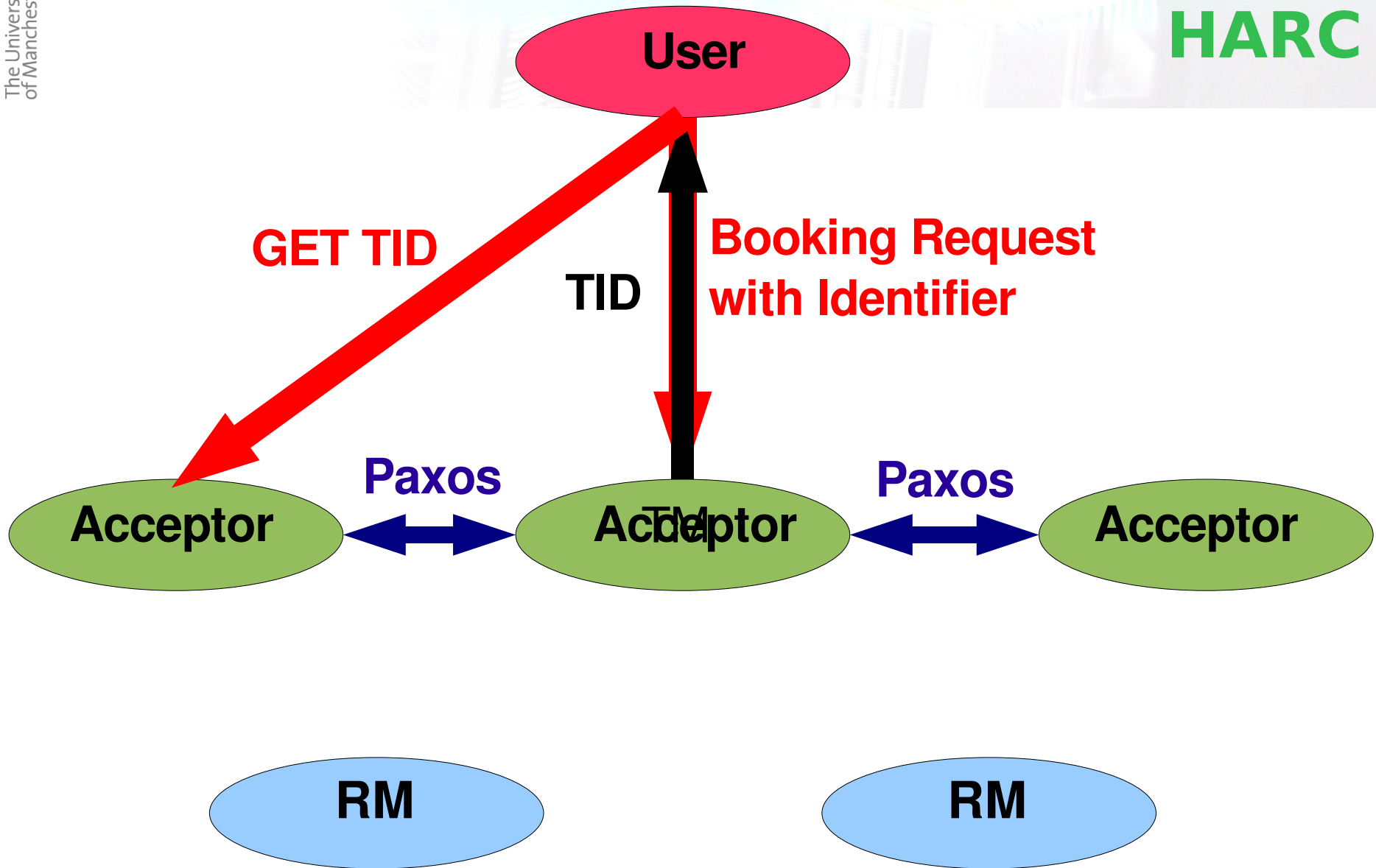
# Consensus

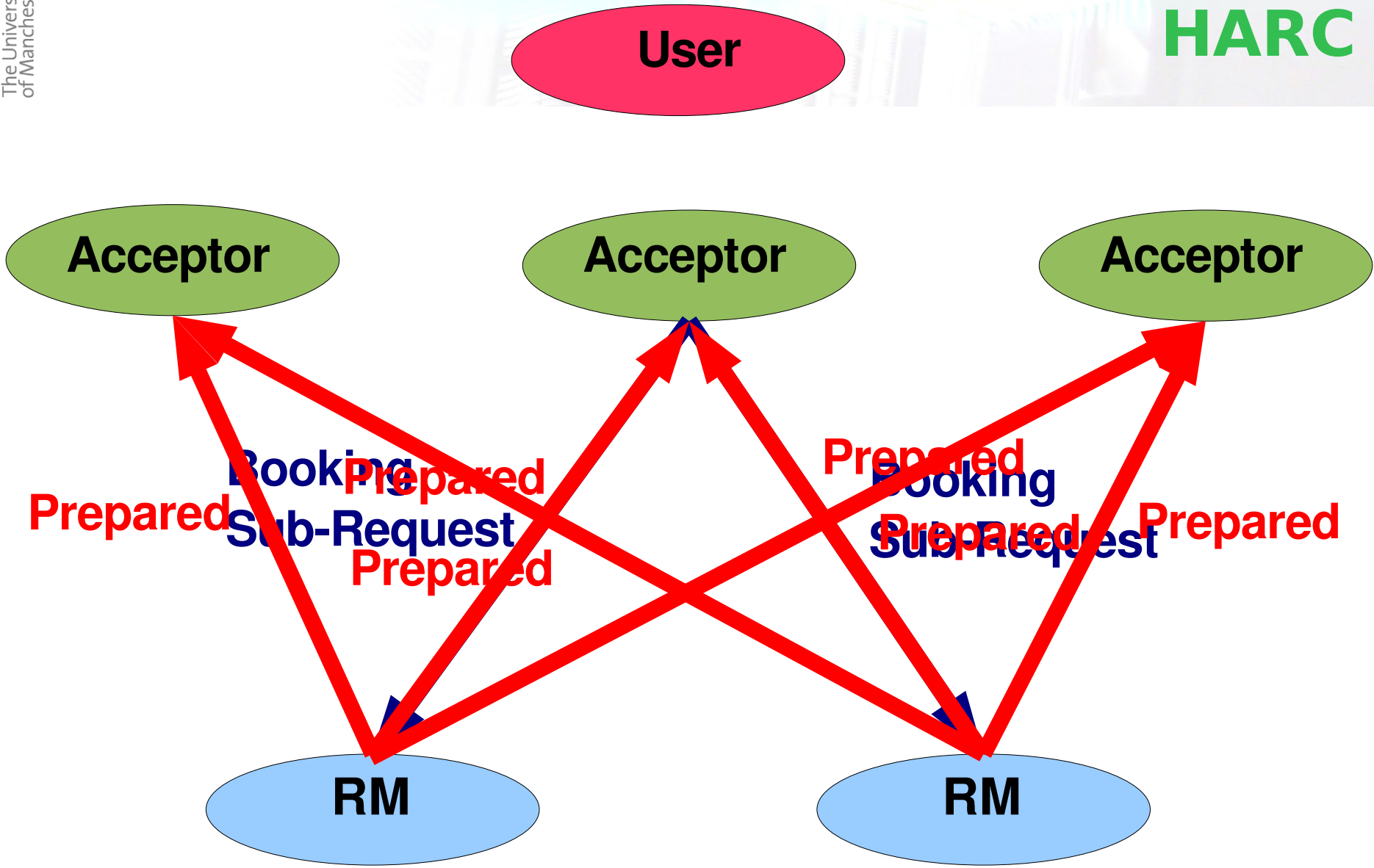
- Co-allocation is a consensus problem.
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- Paxos is a fault tolerant consensus algorithm.
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- Paxos Commit is Paxos applied to the transaction commit problem.

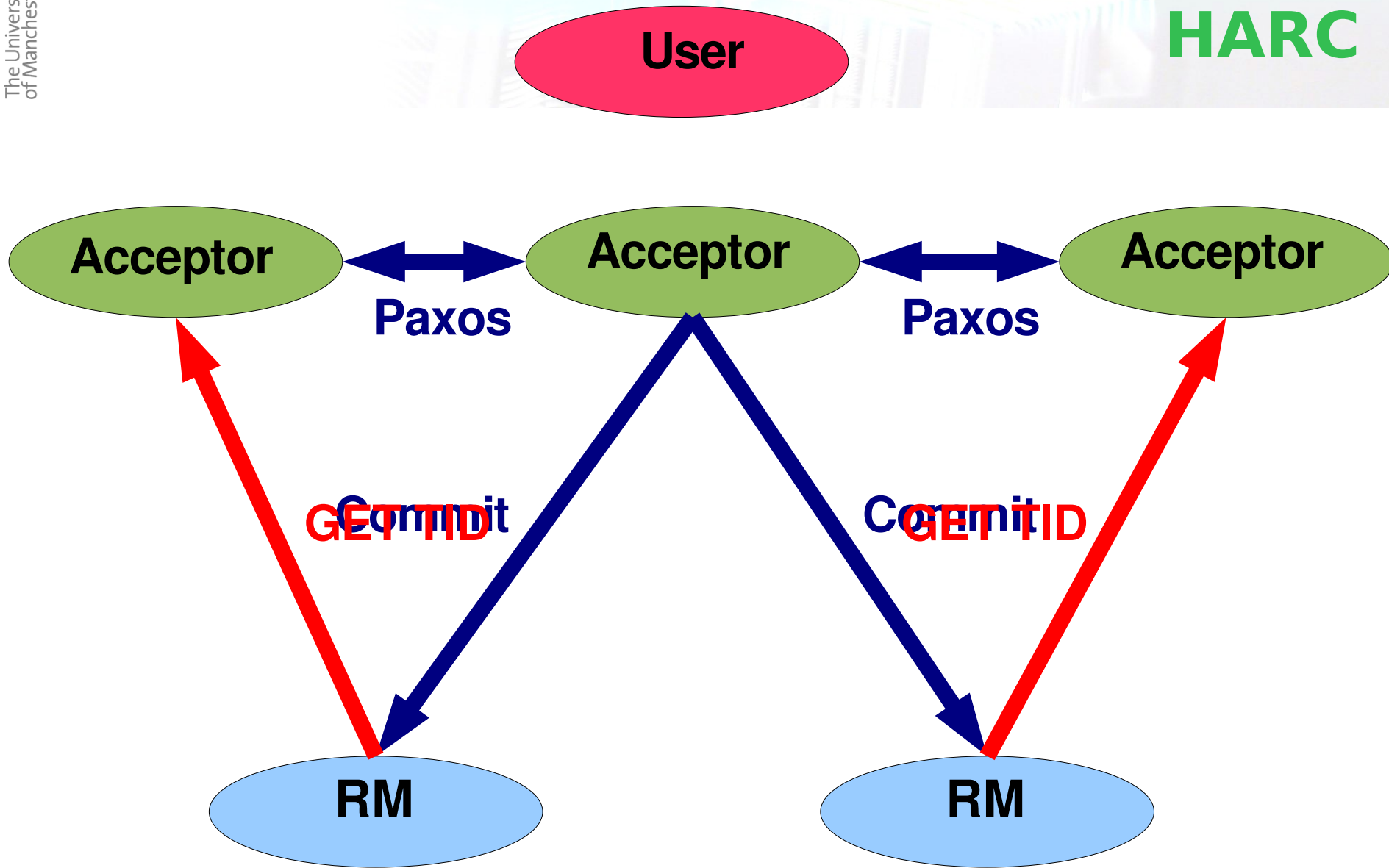
# SOAP or REST?

- REST is a set of design constraints and principles used in designing the WWW protocols.
- Our protocol does not map to WS-CAF, WS-AT or WS-BA.
- Can REST solve this type of problem?

**We choose REST!**







# HARC Availability

- HARC will work as long as there is a majority of acceptors.
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- With 5 acceptors,  $MTTF = 120$  days and  $MTTR = 1$  day,  $MTTF$  of HARC = 160 years.
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- HARC is a fault tolerant approach to making a set of reservations.
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- There is no guarantee that the resources will actually be available at the scheduled time.

# What I learnt...

- Paxos and Paxos Commit can be used to build fault tolerant Grid services.
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- REST can be used to solve complex Grid problems.
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- Hierarchical XML is better than flat SOAP.
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# The Happy Ending

- HARC has been demonstrated at iGrid 2005, SC05 and Global LambdaGrid Workshop 2006.
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- *HARC is available from:*  
<http://www.cct.lsu.edu/personal/maclaren/CoSched/>
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- *Special thanks to Jim Gray, Dean Kuo and Savas Parastatidis*