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PSA experience with LIN

VECTOR LIN SYMPOSIUM
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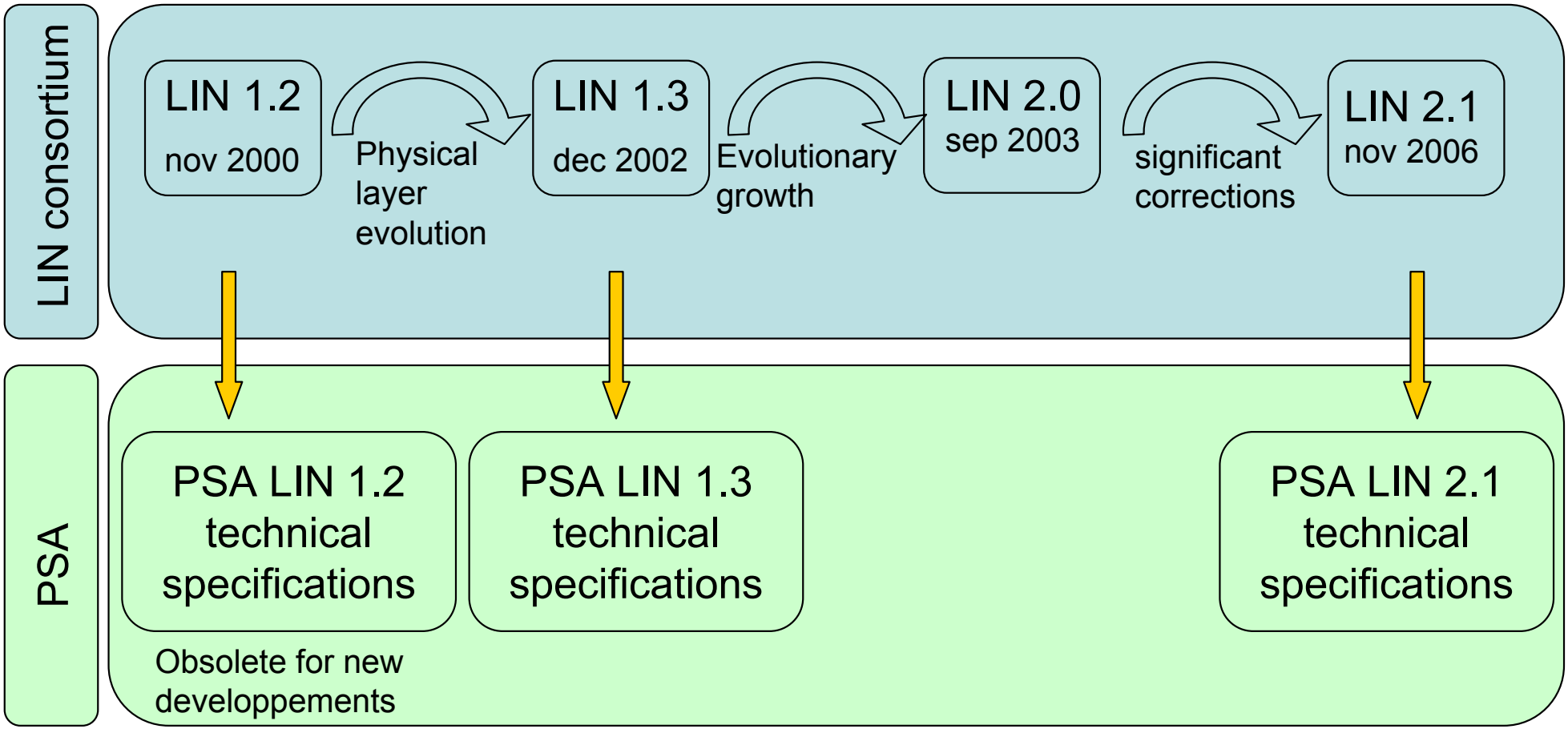
SOMMAIRE

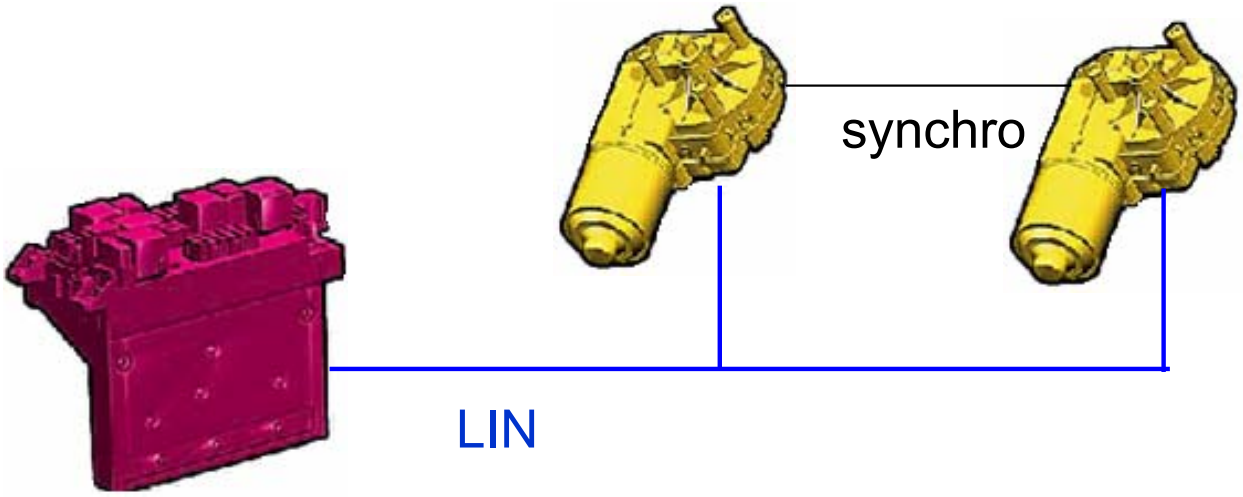
HISTORY of LIN in PSA

- LIN specification roadmap and PSA LIN interfaces specification roadmap:



HISTORY of LIN in PSA

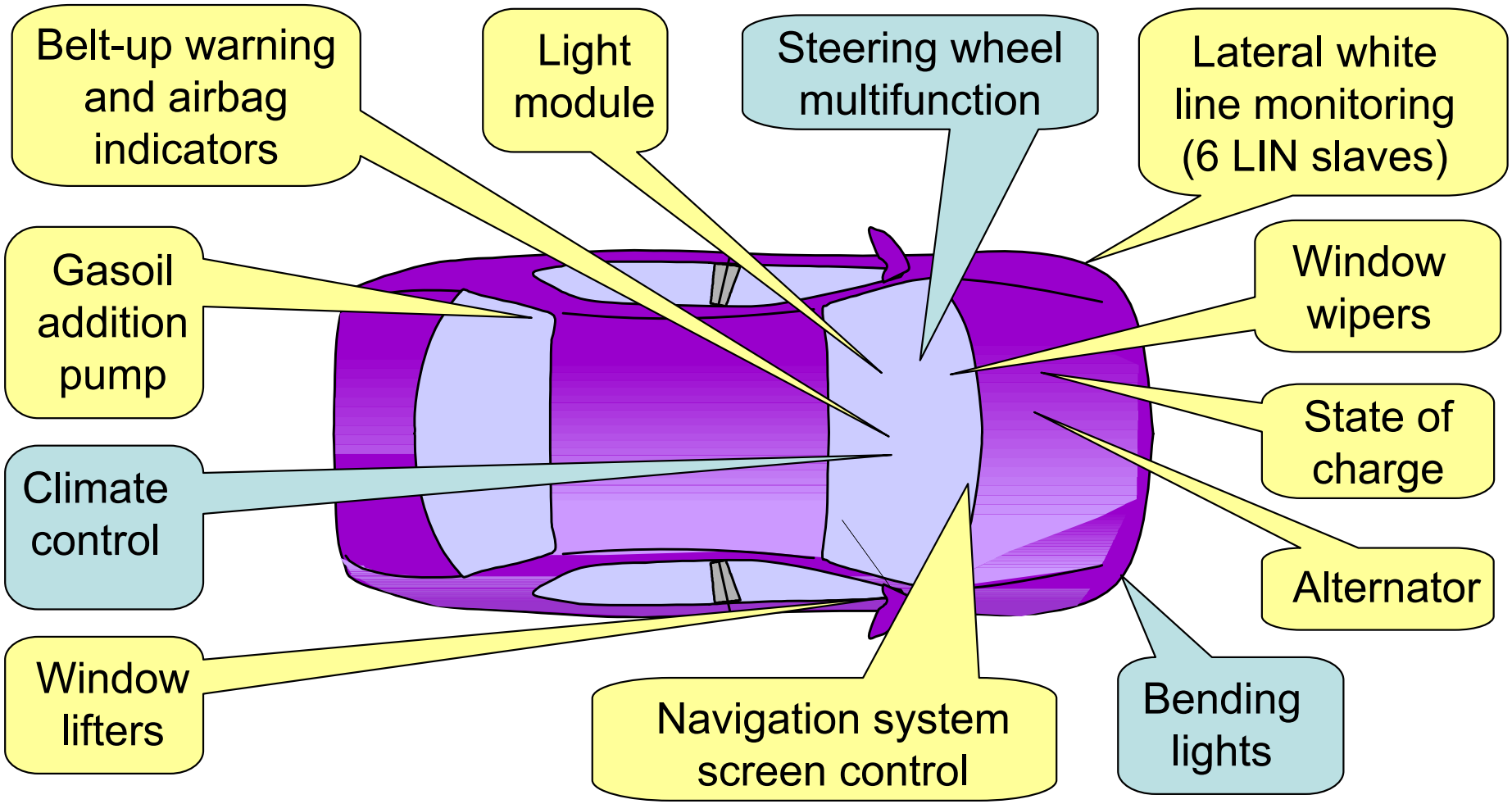
- Successful introduction of LIN in PSA model lines since 2003
  - First LIN application: window-wipers in LIN 1.2 (407 model in 11/2003)



  - Generalization of LIN applications since 207 and C4 models

HISTORY of LIN in PSA

- Actual LIN applications



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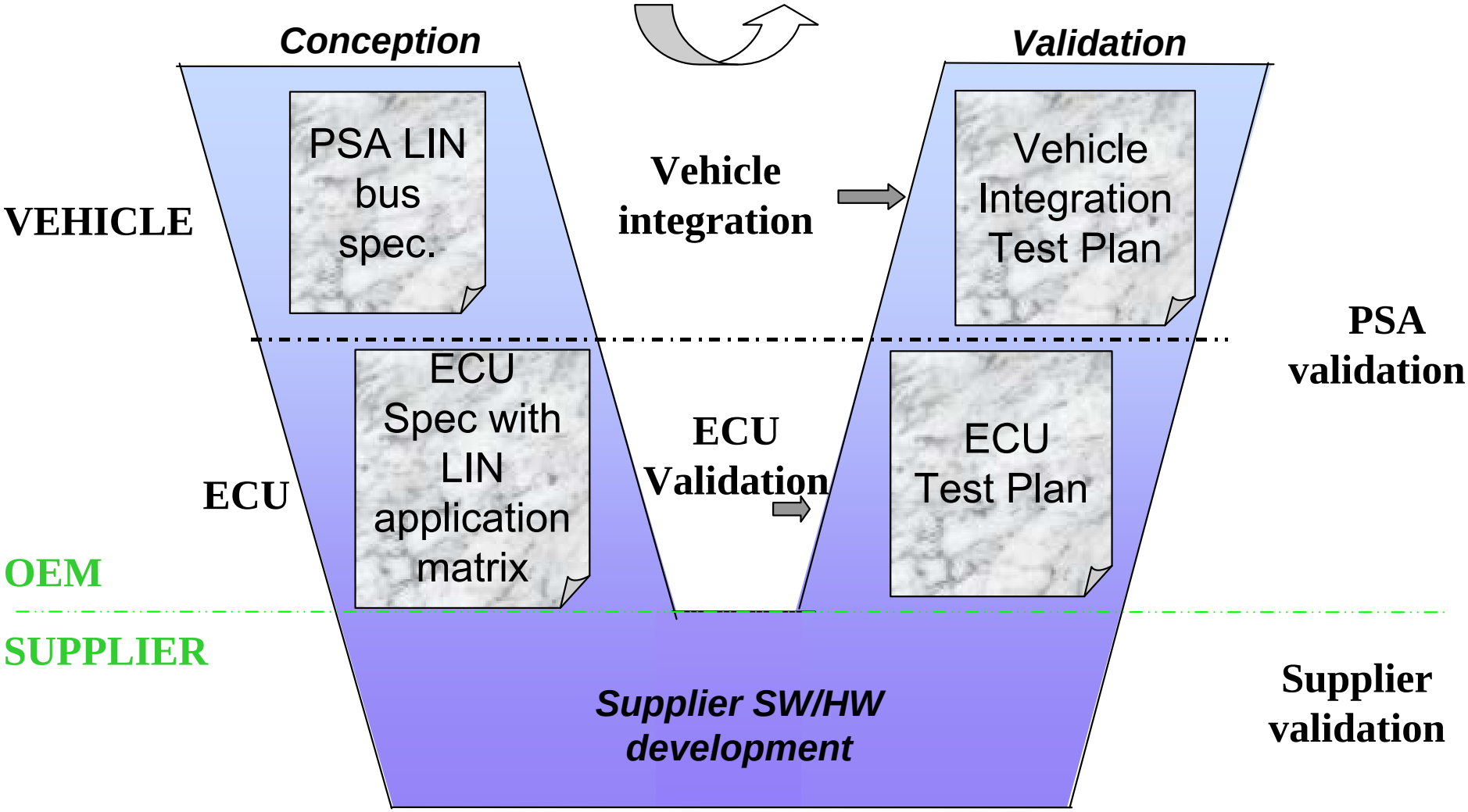
HISTORY of LIN in PSA

- **Why** PSA chose to introduce LIN 2.1
  - Interesting new features
    - Standardization of LIN transport layer for download purposes
    - Standardization of slave to slave communication
    - Sporadic transmission
  - Significant clarifications and corrections of release LIN 2.0
  - Adequacy with component roadmaps and suppliers proposals

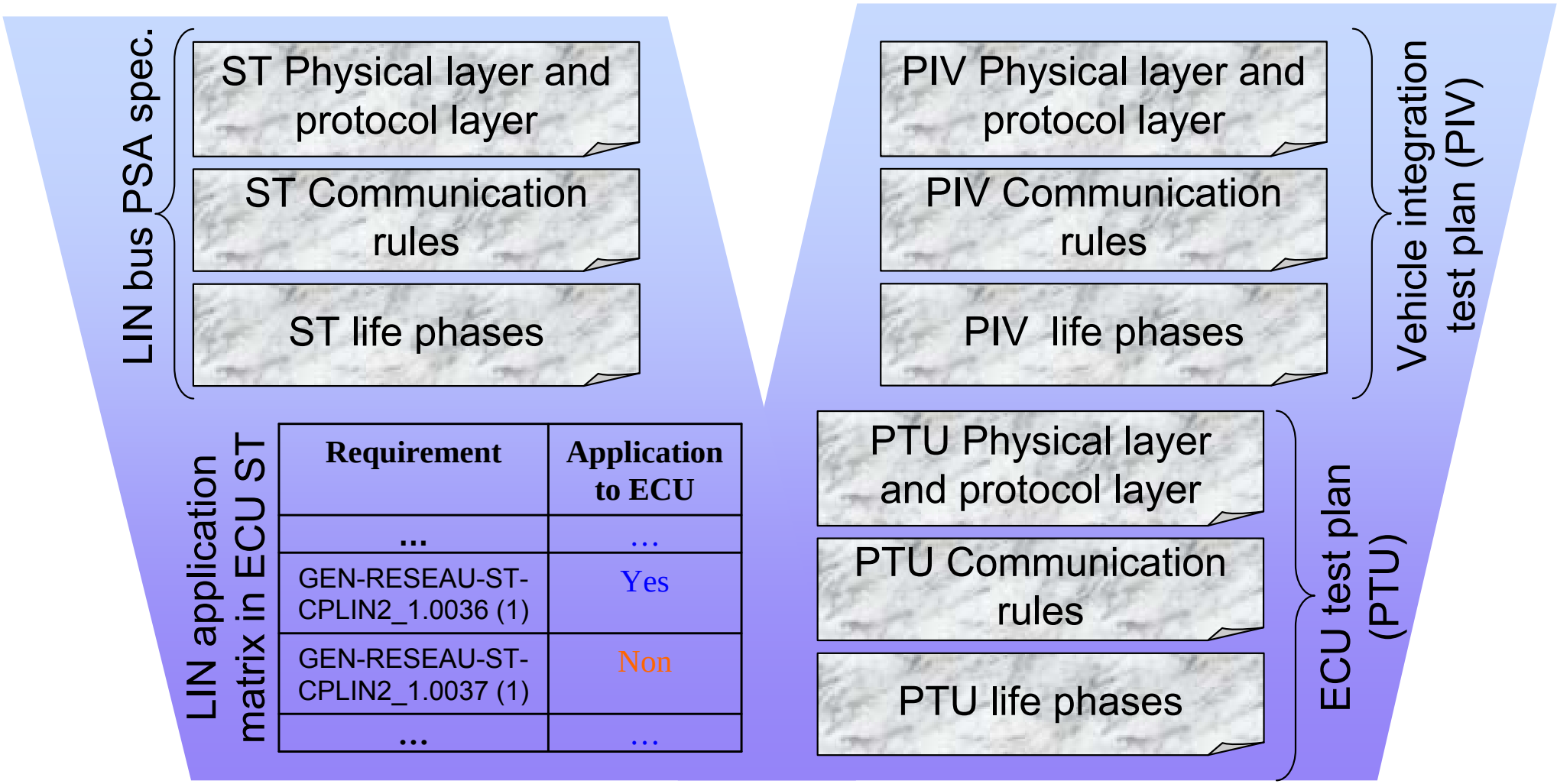
HISTORY of LIN in PSA

- **How** PSA chose to introduce LIN 2.1
  - Kick off for LIN 2.1 developments in 01/2007
  - Firsts targets will be reached > 2010
  - New developments are made on LIN 2.1
  - LIN slaves and local LIN buses will stay on LIN 1.X or migrate to LIN 2.1 according to economic/new functionalities/adequacy with market

LIN Development process V-Model:



LIN Development process: specifications



ST : Technical specification

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PSA LIN 2.1 specifications

- LIN 2.1 specification package is the basis of PSA LIN bus specifications
  - Baud rates : 19200bit/s or 9600bit/s
  - Slave to slave communication :
    - nodes without making use of synchronization
    - bit rate deviation <1% from nominal bit rate
  - Status management is used for slave testability purposes (bit response_error)
  - LIN transport layer for download purposes
  - Sporadic transmission is used

PSA LIN 2.1 specifications

- Standardization of PSA go to sleep procedure
- Wake-up by master or by slave nodes
- ECU types
  - Master handling a bus without slaves sending wake-up request
  - Master handling a bus with slaves sending wake-up request
  - Basic slave (no wake-up request, and no limp home mode)
  - Slave sending wake-up request
  - Slave with communication limp home mode in case of bus inactivity

- Off-the-shelves slave nodes are compatible with basic slaves

PSA COMPONENT COMPLIANCE STRATEGIE

- Compliance requirements :

  Physical layer compliant to LIN 2.1 physical specification

  Protocol layer compliant to LIN 2.1 protocol specification

- PSA do not manage a ‘Golden’ list or ‘Black’ list
- Rank 1 supplier is responsible for component selection and compliance demonstration
- Compliance demonstration is based on a Conformance Justification File (CJF)

  – One CJF / layer / ECU
  – Application of templates defining CJF contents is mandatory

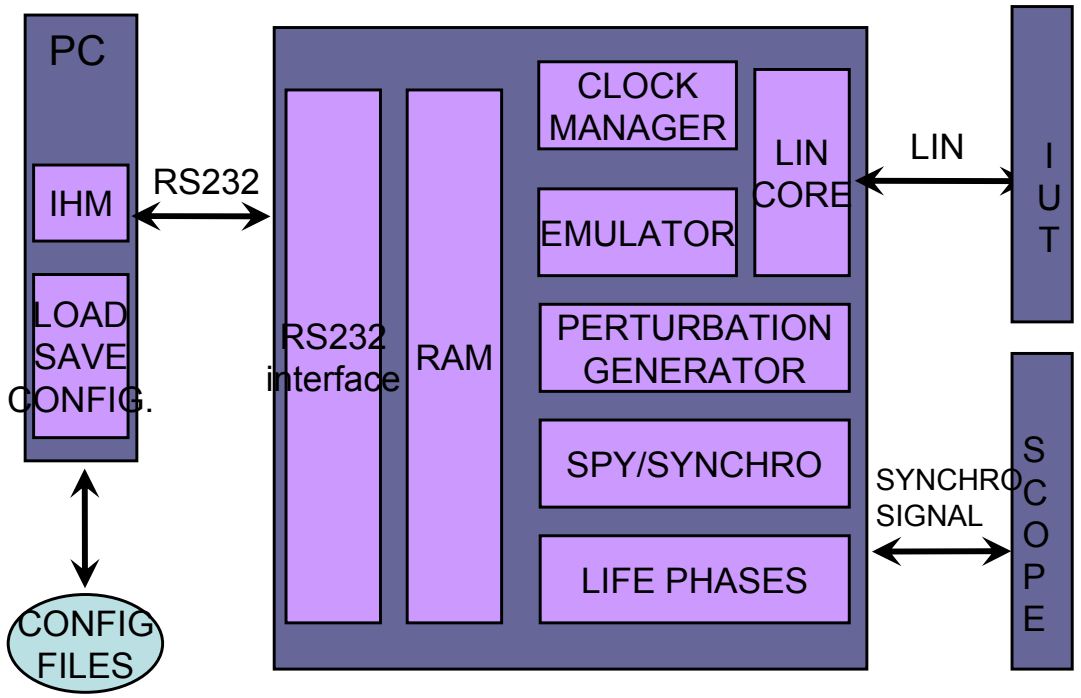
ECU validation

- Supplier validation :
  - Supplier is responsible of UCE compliance to PSA requirements
  - Supplier test plan must be approved by PSA
  - Supplier must deliver an ECU test report at each main release during development
  - Bit precision validation requires worst case analysis in a justification file

- Internal PSA validation at ECU level :
  - PSA focus on integration tests and non interoperability analysis
  - Use of automatic test bench (high coverage, tests are repeatable and comparable, cost efficient

TOOLS

- Use of standard tools
- PSA LIN tool :
  - Adaptation to PSA needs at milestones of LIN introduction
  - Tool behavior is mastered by PSA
  - FPGA core
  - 4 tools in 1:
    - Synchronization and spy tool (each field and each error in a frame)
    - Perturbation tool (perturbation of different fields in the frame)
    - Emulator tool (master or slave)
    - Test scenario generator for life phases
  - Conform to LIN 1.2 and 1.3 (LIN 2.1 update is in progress)
  - Integrated in automatic tester for internal PSA LIN validations



Experiences with LIN 2.1

- Our experience on LIN 2.1 is on conception only
- LIN 2.1 ECU developments are in progress

- Need less clarification on LIN 2.1 than on LIN 2.0
- Only full configured slave node is used by PSA
- LIN conformance test specification is not published
- Some silicon makers does not officially communicate about conformity of existing transceivers to LIN 2.1

Thank you for your attention.

Any questions?

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