picoDB ™

a NoSQL database tool for eLua

Lua Workshop

Reston VA US

November 2012

Tom Freund

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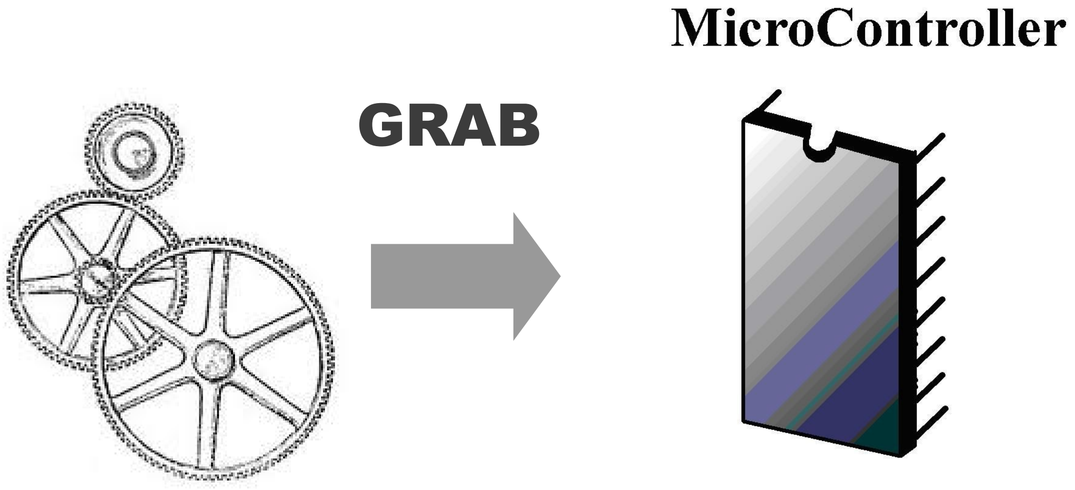
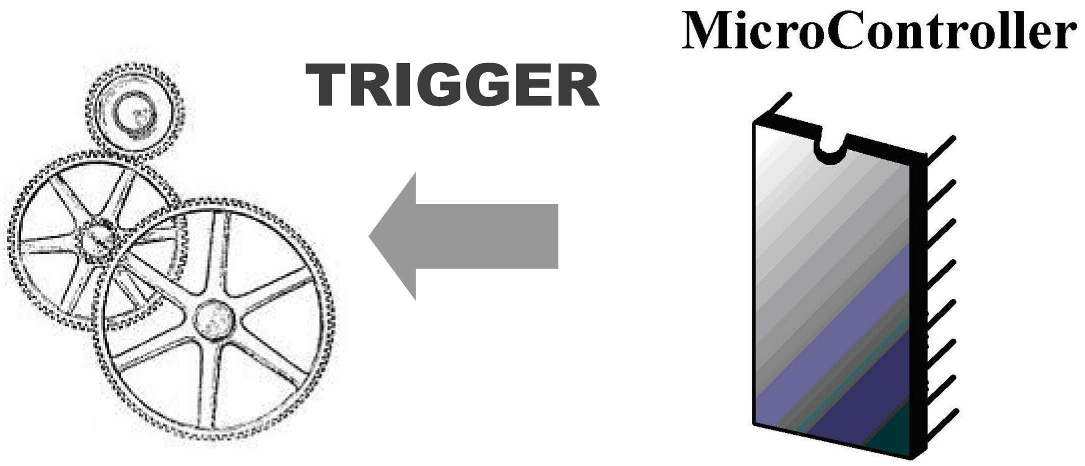
Agenda

- Why picoDB ™
- An overview of picoDB ™
- Using picoDB ™
- Performance characteristics
- Future plans

Why picoDB ™





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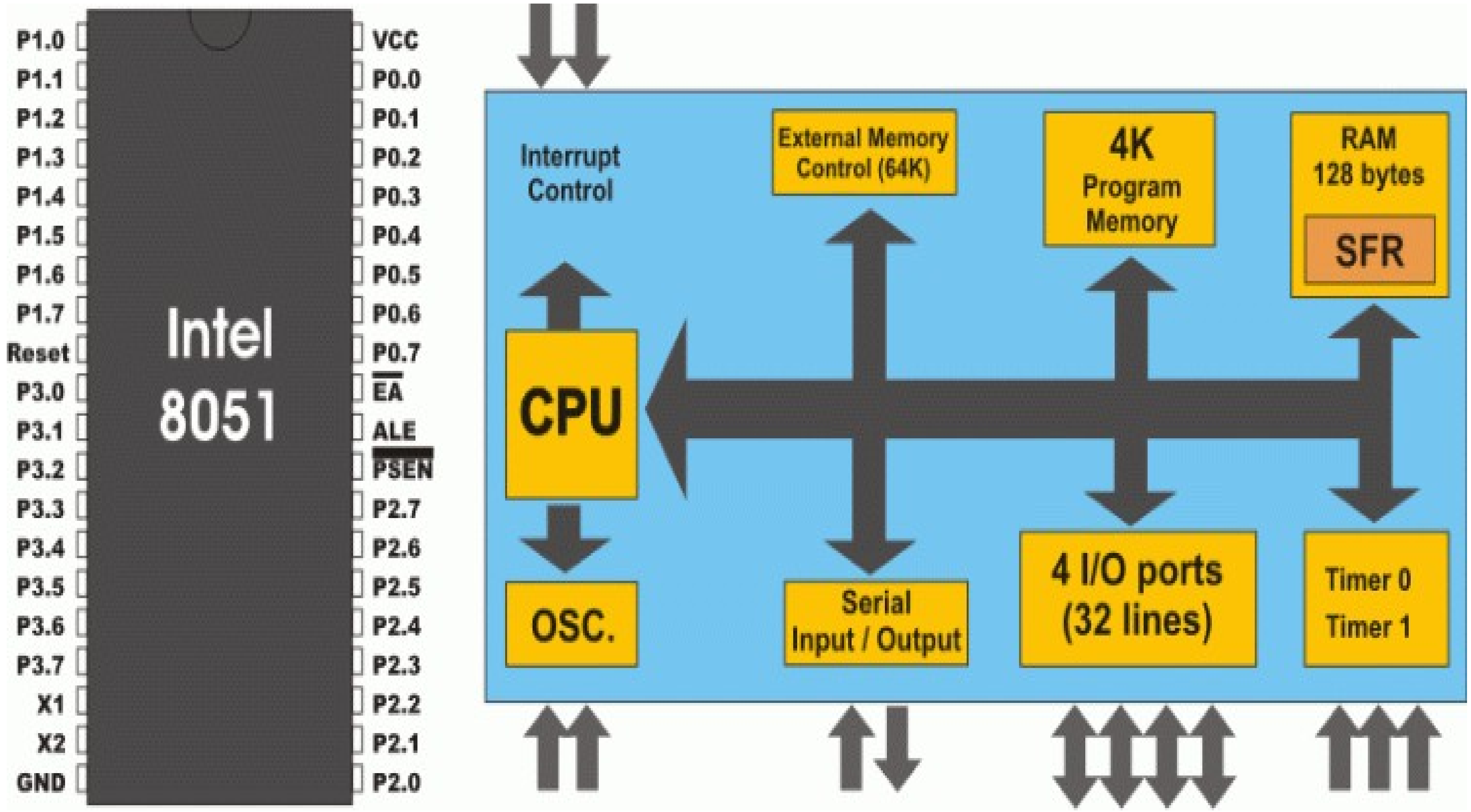
Why picoDB ™



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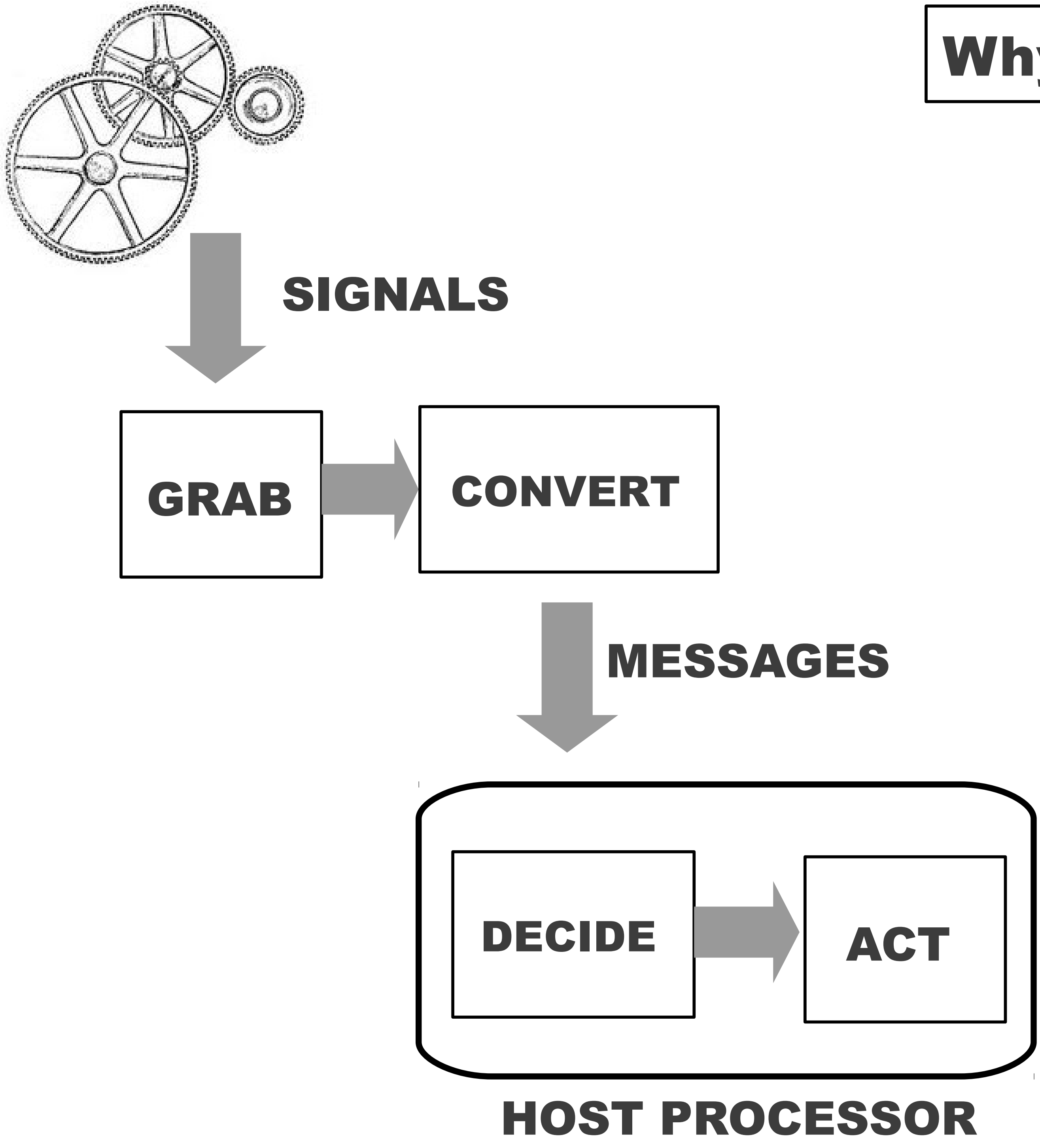

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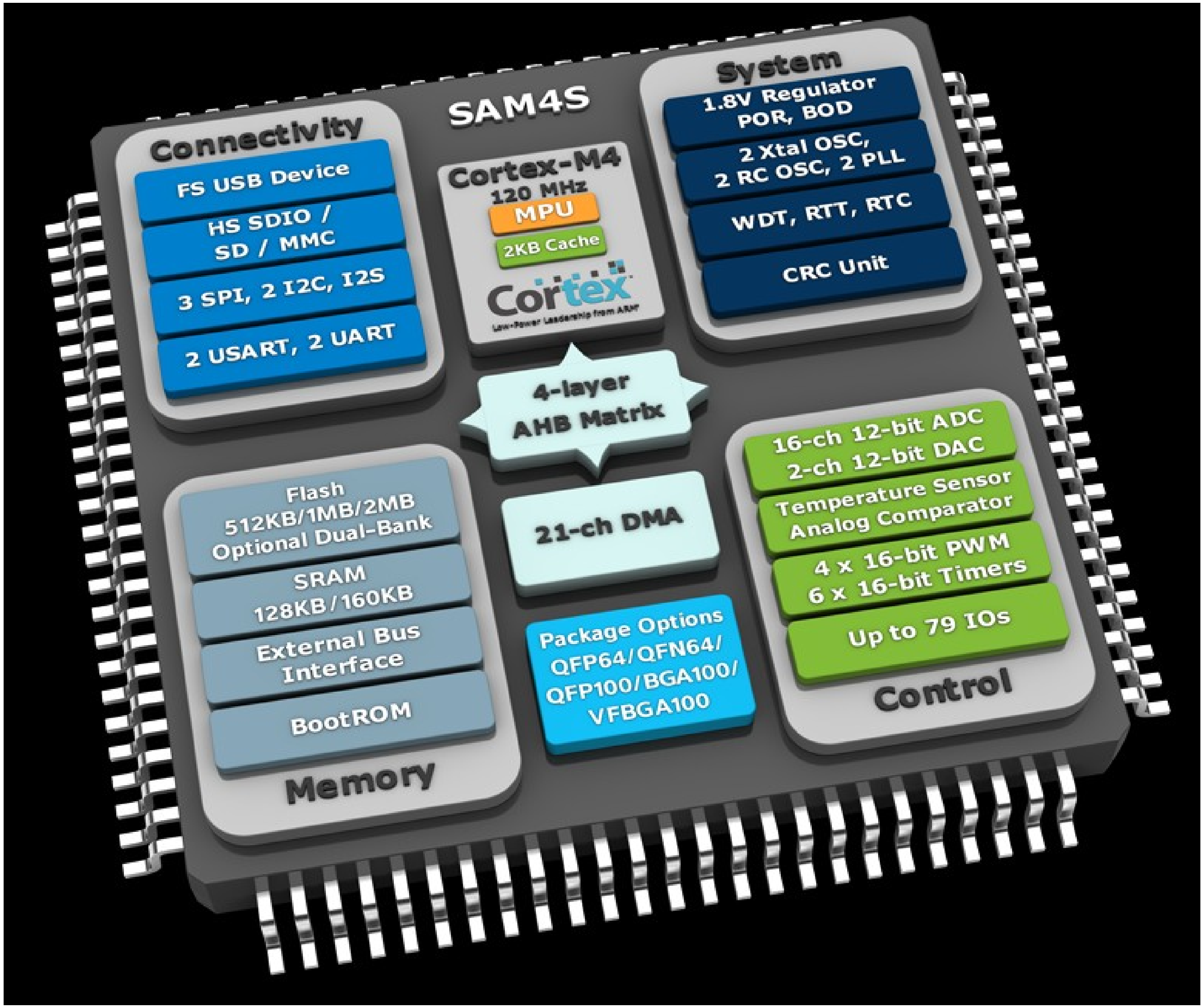

Atmel SAM4S

- **160KB RAM**
- **2 MB Flash**

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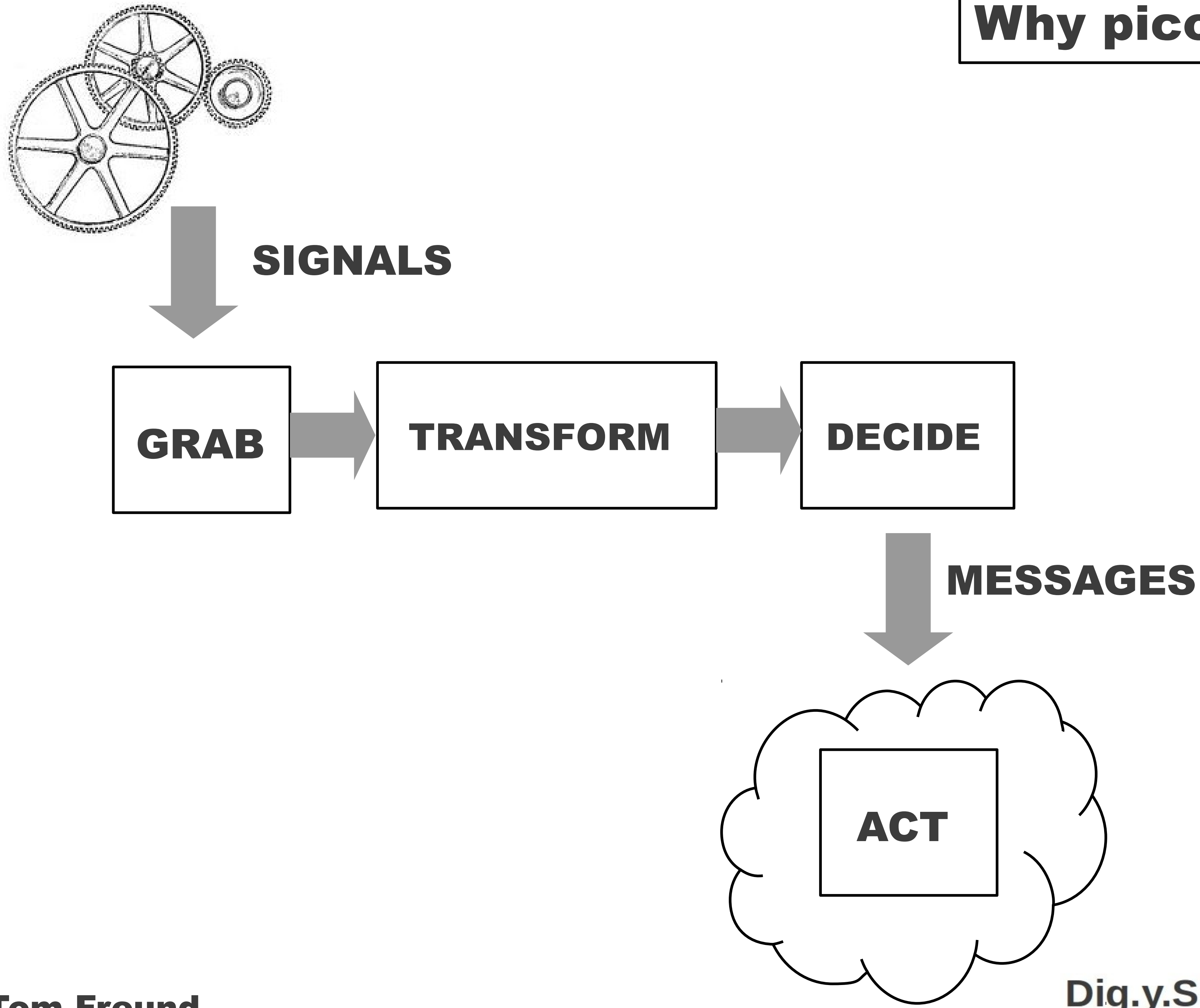

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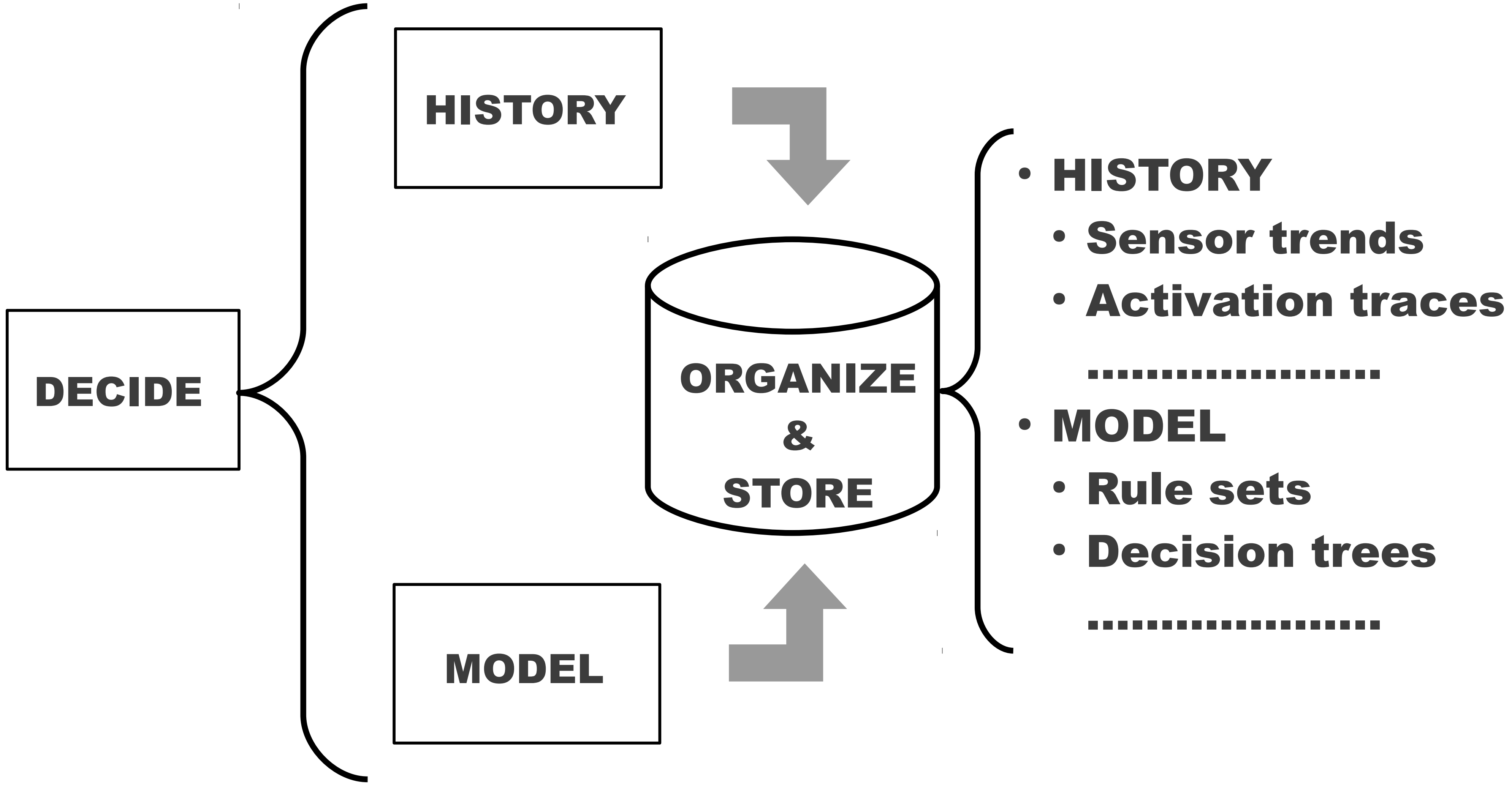
Why picoDB ™



- HISTORY
  - Sensor trends
  - Activation traces
  - ....
- MODEL
  - Rule sets
  - Decision trees
  - ....

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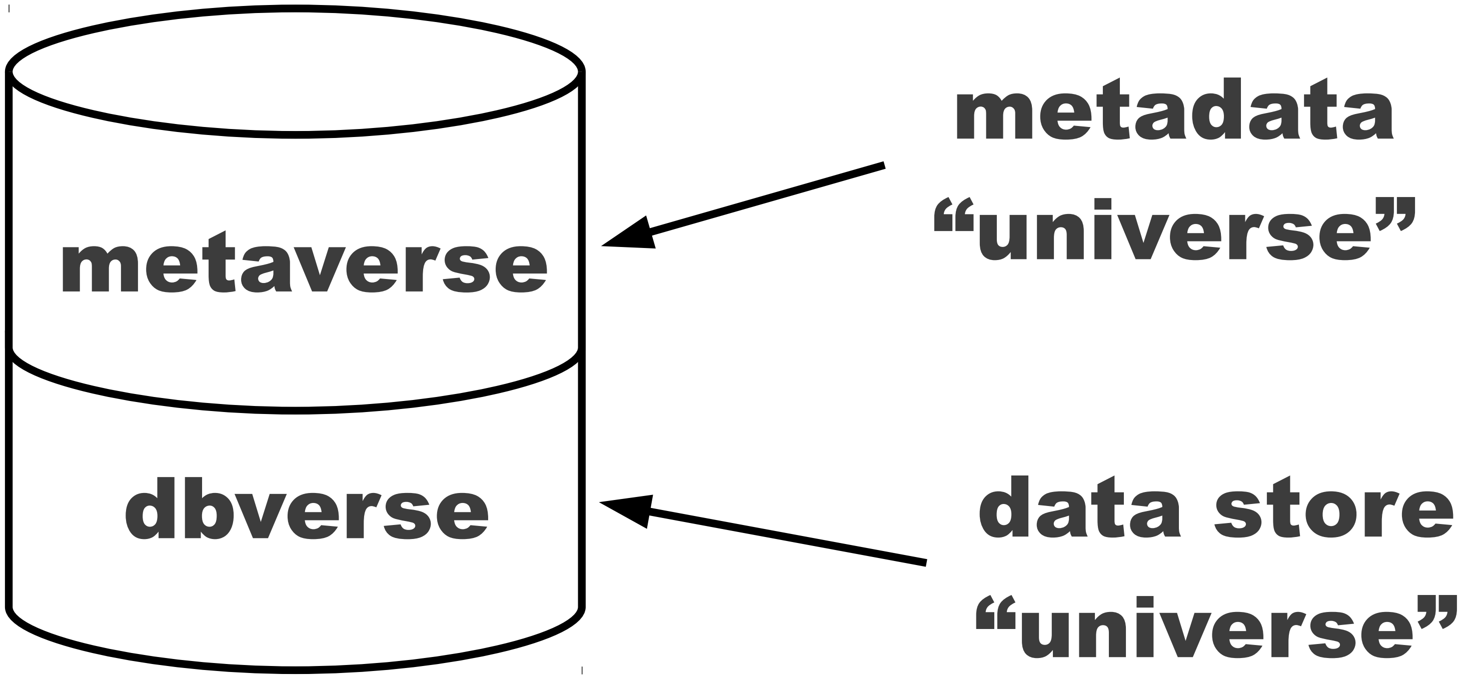
An overview of picoDB ™



multiple 1-table in-memory databases

(initially)

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Using picoDB ™

- dbSETUP – load all database information.
  - returns: status code
- dbCOMMIT – save all database information.
  - returns: status code
- dbDEFINE – add a database through its metadata.
  - returns: status code
- dbLOCATE – locate data tuples to a database subject to data attribute constraints.
  - returns: a list of matching tuples(empty if no match found or an error code

Using picoDB ™

- **dbBUILD – add or change data tuples to a database subject to data attribute constraints (changes only).**
  - **returns: a status code**

- **dbDELETE – remove data tuples to a database subject to data attribute constraints.**
  - **returns: a status code**

- **dbERASE – remove both the metadata and data content of a database**
  - **returns: a status code**

- **dbSORT – provide a list data tuples of a database sorted by up to 2 data attributes.**
  - **returns: data tuple list sorted by the data attribute(s) or an error code**

Using picoDB ™

```
stat = dbDEFINE(“Meas”,{“ID”,”string”,
                      “measure”,”number”})

stat = dbDEFINE(“Coeff”,{“row”,”number”,
                      “column”, “number”,
                      “setting”,”number”})

stat = dbBUILD(“Meas”,”876”,
                              {“ID”,”a0”,
                             “measure”,45.2})
stat = dbBUILD(“Coeff”,”TempF”,
                              {“row”,2,”column”,3,
                             “setting”,0.58})

alst = dbSORT(“Meas”,{“meas”,”ID”})
```

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Using picoDB ™

- **dbMESSAGE – format a message to a device or network based on a message exchange protocol.**
  - **returns: a hexadecimal string representing the message or an error code**

- **dbVERIFY – process a message received from a device or network based on a message processing sequence.**
  - **returns: a status code**

Using picoDB ™

- Metadata – Protocols database

```
picoDB.dbDEFINE("Protocols",
                {"ProtocolID","string",
                "MsgID","string",
                "ParmID","string",
                "ParmType","string",
                "ParmRange","table",
                "ParmDefault", "string",
                "ParmLoc","number",
                "ParmSize", "number"})
```

- Used by dbMESSAGE to create device or network messages

Using picoDB ™

- Metadata – Verifier database used by dbVERIFY

```
picoDB.dbDEFINE("Verifier",
            {"ProtocolID","string",
            "MsgID","string",
            "ParmID","string",
            "ParmProcess","table"})
```

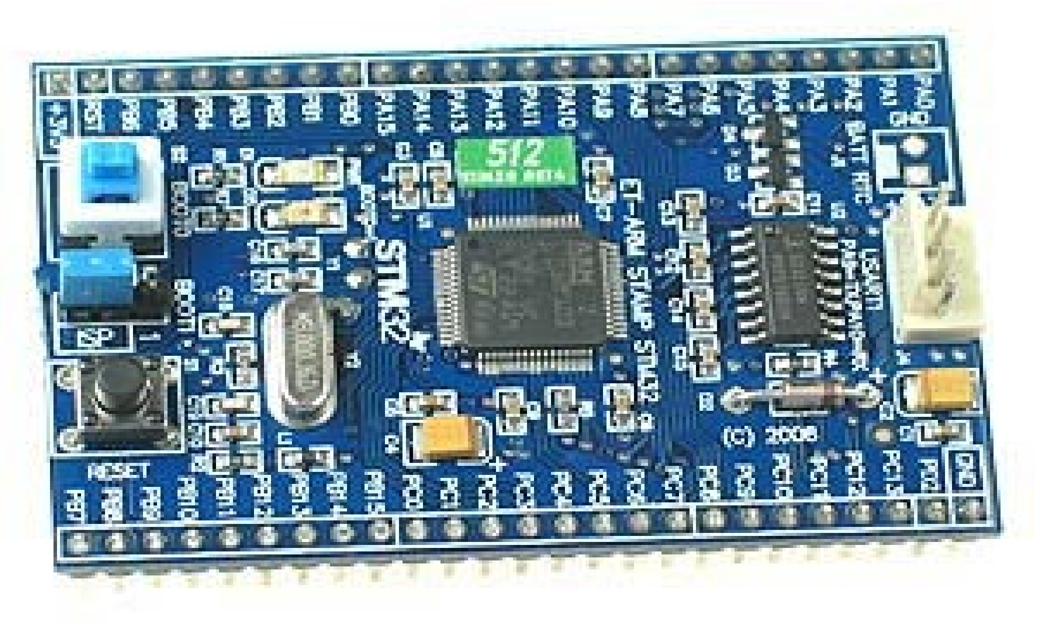
- Used to process device or network messages
- ParmProcess uses a stack machine structure
  - example – convert Celsius to Fahrenheit
    - {"P_",9,"*",5,"/",32,"+","=R_Temp_Val"}

Using picoDB ™

- Example – using dbMESSAGE with dbVERIFY

```
require "picoDB"
while true do
    msg = picoDB.dbMESSAGE("TempHum","RQHum",{1,"H"})
    if type(msg) ~= "string" then
        -- deal with error condition
    end
    -- request and retrieve data from a humidity sensor
    .........
    stat = picoDB.dbVERIFY("TempHum","RSHum",devresp)
    if stat ~= 0 then
        -- deal with error condition
    else
        – perform analysis or forward info
    end
end
```

Platform – Futurlec ET-STM32 Stamp



- MCU - ARM Cortex M3 (72 MHz, 90 MIPS)
- Internal RAM – 64 KB
- Internal Flash – 512 KB
- Dim (L X W X H) – 42 mm X 65 mm X 60 mm (1.7” X 2.6” X 2.4”)

Performance characteristics

- Scenario – ongoing alpha testing
  - Sample temperature-humidity acquisition cycle
    - picoDB + chunk using dbVERIFY and dbMESSAGE
      - no I/O to sensors
      - Protocol and Verifier tables
    - build via eLua Builder – eLua site
      - binary (ROMable) image: 270KB
      - reference eLua footprint
        - Flash – 256KB
        - RAM – 64 KB
    - Preliminary results – 1 millisecond per cycle

Future plans

- Commercial
    - picoChain ™ – 1Q 2013
    - development and deployment tools
- Community
    - Sourceforge – 2Q 2013

Questions ?

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