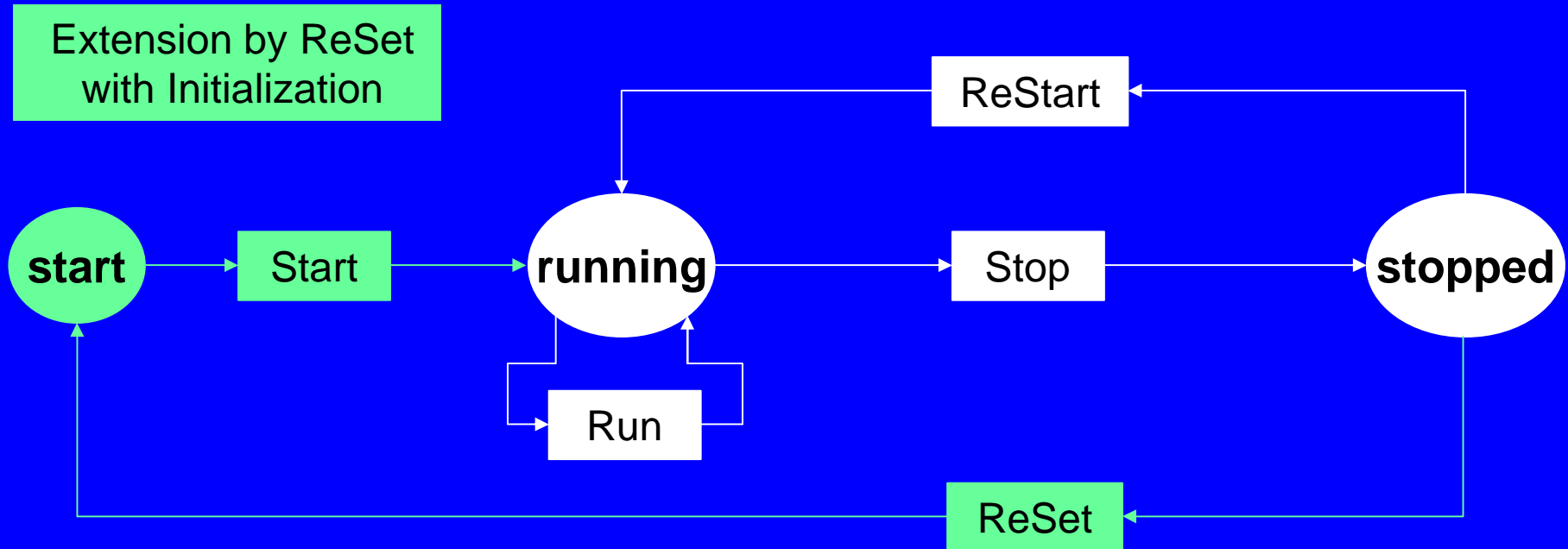


Illustrating the ASM Function Classification

- A real-time CLOCK:
 - Monitored: CurrTime : Real (supposed to be increasing)
 - Controlled: DisplayTime : Nat x Nat
 - Static: Δ : Real (system dependent time granularity), +, conversion (from Real to Nat),
- The Rule:
 - If $\text{DisplayTime} + \Delta = \text{CurrTime}$
 - Then $\text{DisplayTime} := \text{conversion}(\text{CurrTime})$
- Separating guard computation by derived fct, e.g.
 - $\text{ClockTick} = 1$ iff $\text{CurrTime} = \text{DisplayTime} + \Delta$the rule becomes
 - If ClockTick then $\text{DisplayTime} := \text{CurrTime}$

Extending CLOCK to a Stopwatch

monitored ClockTick indicating the measured time interval
monitored StartStop (e.g. event consumed upon rule firing)



Run ° If ClockTick then CountTicks:=CountTicks+1
Emit(CountTicks+1)

Stop ° **ReStart** ° If StartStop then Skip

Start ° If StartStop then CountTicks:=0
ReSet ° If Reset then Skip

Emit (Time) °
DisplayTime:= Time

Initially stopped with
CountTicks=0

Assuming StartStop and Reset as disjoint

Exercise

- Refine the Stopwatch by intermediate time handling
 - Introduce a new input signal Lap to record an intermediate time while continuing to measure the global time.
 - An occurrence of Lap freezes the time on the display, while the internal stopwatch time continues to be computed. The next occurrence of Lap puts the stopwatch back to run time display.

References

- G. Berry: Programming a digital watch in Esterel v3_2.
 - In: TR 08/91, Centre de Mathematiques appliquees, Ecole des Mines de Paris, Sophia-Antipolis 1991
- N. Halbwachs: Synchronous programming of reactive systems
 - Kluwer 1993
- E. Börger, R. Stärk: Abstract State Machines. A Method for High-Level System Design and Analysis Springer-Verlag 2003, see <http://www.di.unipi.it/AsmBook>
 - See Chapter 3