What Drives Me?

I like to build computers

- Not use them!
- And the more novel (i.e. wacky) the better

But I can’t get $ to do this unless

- They solve some problems “better” than today
- AND I can prove it
- AND they can be programmed by other than ninja programmers

So! Understanding inherent properties of computing is crucial
procedure MORA;
begin
parallel_array A(*, 0::m-1);
A[i,0] = ai, (1 ≤ i ≤ N)
for q = 1 step q+m-1 until (N-m+1)/2 do 
for j = 1 step 1 until m-1 do 
begin 
A[i,j]=A[i,j-1], (1≤i≤q+j-1);
A[i,j]=g(A[i,j-1], A[i-1,j], q+j-1);
end;
A[i,0] = h(A[i,0], A[i-q, m-1], …, A[i-q-m+1,0]), (q+m≤i≤N);
end;
x_i = f(A[i,0], x_0, … x_{m-1}), (1≤i≤N);
end MORA.
Novel Architectures

Procedure MORA:
begin
    parallel_array A(*, 0::m-1);
    A[1,0] = a_i, (1 ≤ i ≤ N)
    for q = 1 step q+m-1 until (N-m+1)/2 do
        begin
            for j = 1 step 1 until m-1 do
                begin
                    A[i,j] = A[i,j-1], (1 ≤ i ≤ q+j-1);
                    A[i,j] = g(A[i,j-1], a_i-q-j+q), (q+j ≤ i ≤ N);
                end;
            end;
            A[i,0] = h(A[i,0], A[i-q, m-1], ... , A[i-q-m+1,0]), (q+m ≤ i ≤ N);
        end;
    A[i,0] = A[1, m-1], (1 < i ≤ q+m-1);
end;

x_i = f(A[i,0], x_0, ... x_{-m+1}), (1 ≤ i ≤ N);
end MORA.
procedure MORA:
begin
parallel_array A[* , 0::m-1];
A[i,0] = a_i, (1 ≤ i ≤ N)
for q = 1 step q+m-1 until (N-m+1)/2 do
begin
for j = 1 step 1 until m-1 do
begin
A[i,j]=A[i,j-1]; (i≤q+j-1);
A[i,j]=A[i,j], A[i-j+m,0], (q+j ≤ i ≤ N);
end;
end;
A[i,0] = h(A[i,0], A[i-q, m-1], ..., A[i-(q+m-1)], (1≤i≤N), end;
end;
end MORA.

Parallel Recurrences (1971)
Space Shuttle IOP (1974)
IBM 3838 (1976)
1st Book (1981)
RTAIS: (1990)
2nd Book (1990)

Gossamer Architecture (now)

Big Data and Big Graphs (now)

EXECUBE (1993)

Traveling Threadlets (2007)
HPCS Cascade (2002-2006)
PIM Lite (2004)
DIVA (1998-2001)
HTMT (1997-2001)
PIM Petaflop Architecture (1994)
procedure MORA:
begin
parallel_array A(*, 0::m-1);
A[i,0] = a_i, (1 ≤ i ≤ N)
for q = 1 step q+m-1 until (N-m+1)/2 do
begin
for j = 1 step 1 until m-1 do
begin
A[i,j] = A[i,j-1], (1 ≤ i ≤ N);
end;
end;
A[i,0] = A[1, m-1], (1 < i ≤ q+m-1);
end;
x_i = f(A[i,0], x_0, … x_{m-1}), (1 ≤ i ≤ N);
end MORA.