ANOTHER LOOK AT COMPUTER COMMUNICATION PROTOCOLS

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(Copies of Transparencies)

ANOTHER LOOK AT COMMUNICATIONS PROTOCOLS

· Protocols are the conventions that <u>connect</u> the various layers of communication.

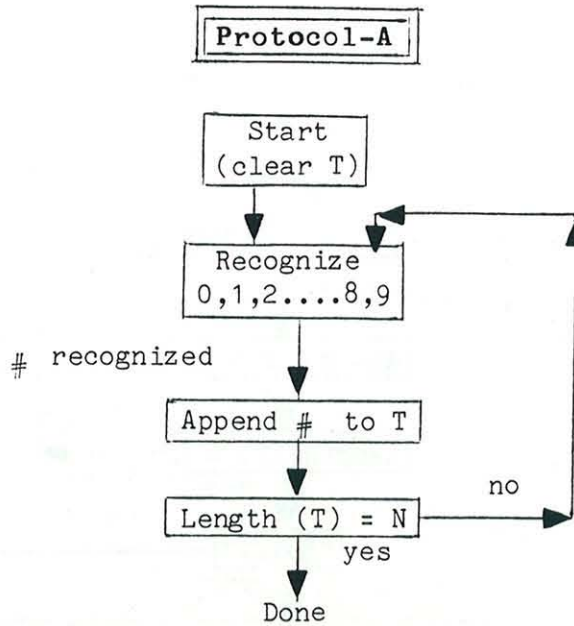· Protocols are the conventions that <u>separate</u> the various layers of communication.

·   **All good things come in heptads!**

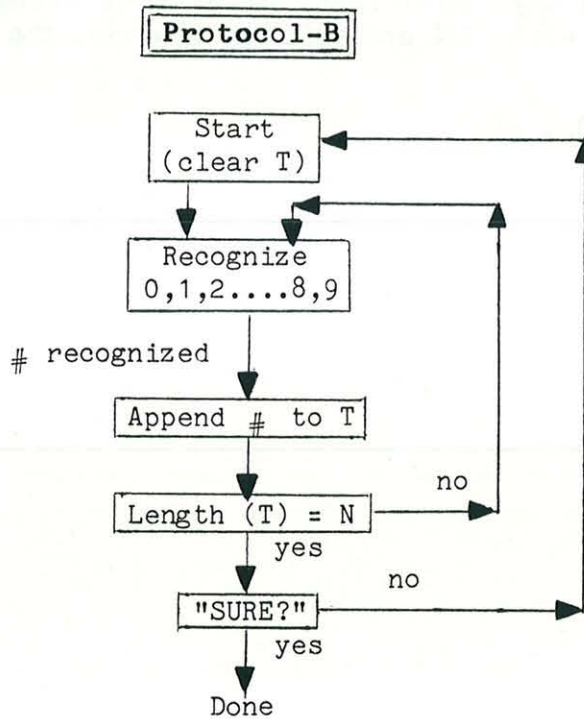| 7	Application	Sloth	Immortality
6	Presentation	Avarice	Wholeness
5	Session	Gluttony	Kingdom
4	Transport	Lust	Right mindedness
3	Network	Envy	Truth
2	Link	Wrath	Good Mind
1	Physical	Pride	The Holy Spirit

· Protocols are typically designed to work RIGHT.

    Preferably with a mathematical proof of the correctness.

· Many protocols are not designed for optimal performance.

    (Performance, like paint, can always be added later ....).

EXAMPLE

VOICE ENTRY PROTOCOL.

| Protocol-A |

```
      Start
    (clear T)
         │
         ▼           ◄──────────┐
     Recognize                  │
     0,1,2....8,9               │
         │                      │
  # recognized                  │
         │                      │
         ▼                      │
   Append # to T                │
         │                      │
         ▼              no       │
  Length (T) = N ──────────────►┘
         │ yes
         ▼
       Done
```

. If p is the probability of correct recognition then p^N is the success probability of the entire transaction.

. Its length is N entries.

. | Protocol-B |

```
      Start      ◄──────────────────┐
    (clear T)                        │
         │                           │
         ▼          ◄──────┐         │
     Recognize             │         │
     0,1,2....8,9          │         │
         │                 │         │
  # recognized             │         │
         │                 │         │
         ▼                 │         │
   Append # to T           │         │
         │          no      │         │
         ▼        ─────────►┘         │
  Length (T) = N                      │
         │ yes                        │
         ▼            no              │
    "SURE?" ─────────────────────────►┘
         │ yes
         ▼
       Done
```

. If p is the probability of correct recognition then it always succeeds with 100% probability. However, the expected length is

$$\frac{N+1}{p^N}$$

```
                    ┌──────────────┐
              ┌────►│    Start     │◄─────────────┐
              │     │  (clear T)   │              │
              │     └──────────────┘              │
              │            │                      │
              │            ▼                      │
    Reset     │     ┌──────────────┐              │
              │     │  Recognize   │              │
              ◄─────┤ 0,1..9,"reset"├──────┐      │
                    └──────────────┘       │      │
                           │               │      │
                  # recognized             │      │
                           ▼               │      │
                    ┌──────────────┐       │      │
                    │ Append # to T│       │      │
                    └──────────────┘       │      │
                           │               │      │
                           ▼          no   │      │
                    ┌──────────────┐───────┘      │
                    │ Length (T) = N│              │
                    └──────────────┘              │
                        yes │           no         │
                            ▼  ◄───────────────────┤
                    ┌──────────────┐               │
                    │   "SURE?"    ├───────────────┘
                    └──────────────┘
                        yes │
                            ▼
                          Done
```
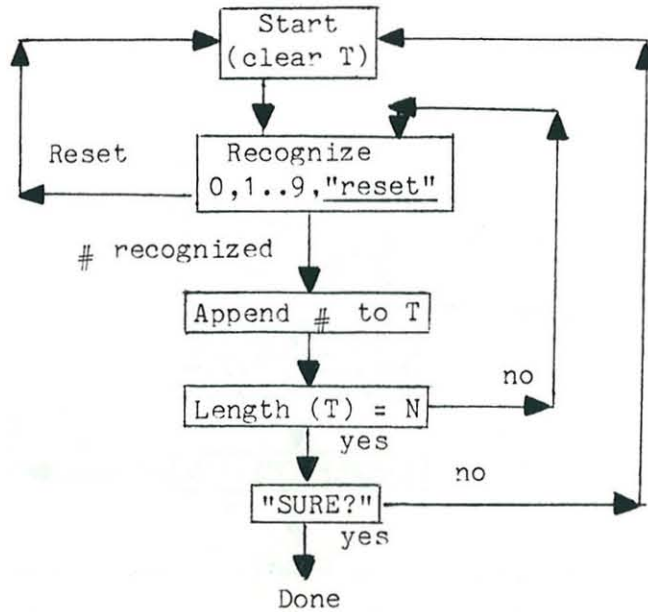
If p is the probability of correct recognition then it always suceeds with 100% probability. However, the expected length is
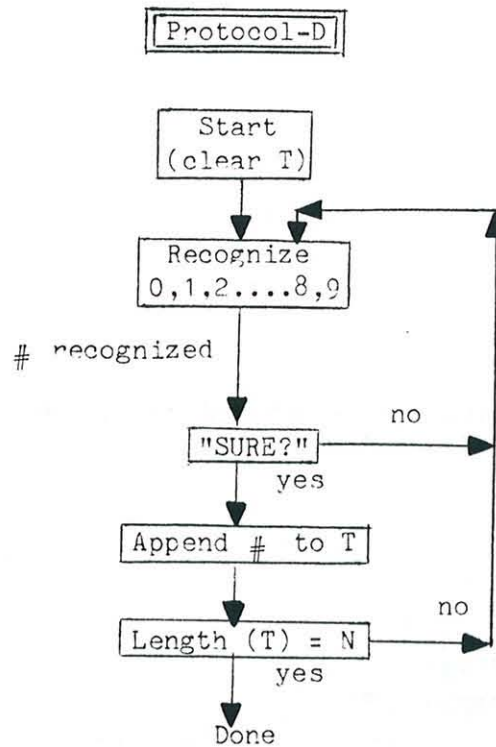
$$\sum_{n=0}^{N+1} p^{-n} - p^N$$

```
                    ┌─────────────┐
                    │ Protocol-D  │
                    └─────────────┘

                    ┌──────────────┐
                    │    Start     │
                    │  (clear T)   │
                    └──────────────┘
                           │          ┌──────────────────┐
                           ▼          │                  │
                    ┌──────────────┐  │                  │
                    │  Recognize   │  │                  │
                    │ 0,1,2....8,9 │                     │
                    └──────────────┘                     │
                                                         │
         # recognized                                    │
                                                         │
                           │                             │
                           ▼              no             │
                    ┌──────────────┐ ───────────────►    │
                    │   "SURE?"    │                     │
                    └──────────────┘                     │
                          yes                            │
                           │                             │
                           ▼                             │
                    ┌──────────────┐                     │
                    │ Append # to T│                     │
                    └──────────────┘                     │
                           │                  no         │
                           ▼              ───────────►   │
                    ┌──────────────┐
                    │ Length (T) = N│
                    └──────────────┘
                          yes
                           │
                           ▼
                         Done
```

- If p is the probability of correct recognition then it always
  succeeds with 100% probability. However, the expected length is
  $\frac{2N}{p}$

- **There is substantial similarity between these protocols
  and FTP.**

- **The relative merit of these protocols is a function of both
  N and p (N is static, p is dynamic).**

- **For optimal performance the choice of protocol should be
  done online (adaptively) according to the dynamic p.**

- **How many Protocols do that?**

EXAMPLE

Car Rental Operation

A Typical Request

. Need N1 cars of class C1 for D1 days;

. Need N2 cars of class C2 for D2 days;

. END

. The same person who is trained to handle these requests can also handle other kinds of requests.

Other Messages:

. "Speak Louder"

. "No spiko Inglaz
Hable usted Espanol?"

. "Do this: open the top drawer and look for...."

. **Typically, communication systems treat messages as <u>data</u> for a certain program (the "protocol handler").**

. **Is this the only possible model?**

. **It may be interesting also to be able to communicate not just data, but also real instructions to accomplish tasks which were not predicted.**

. **It sure will be nice to have smart and intelligent* set of protocols.**

. **No protocol can be smarter than the committee defining it.**

How sad!

. **How should protocol be designed (and implemented) in a computation-plenty environment?**

Conclusion

. Smarter protocols (and processes to handle them) would be nice to have.

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* INTELLIGENT is a registered trademark of the AI community.