MODULARITY IN

DISTRIBUTED FEATURE COMPOSITION

and

THIRTEEN YEARS OF LEARNING FROM MICHAEL JACKSON

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SOME THINGS I LEARNED FROM MICHAEL

WHAT TO SAY . . .

. . . after asking the staff of a restaurant to turn the music down, and being told, "We can't, the customers like it."

(possibilities too numerous to list)
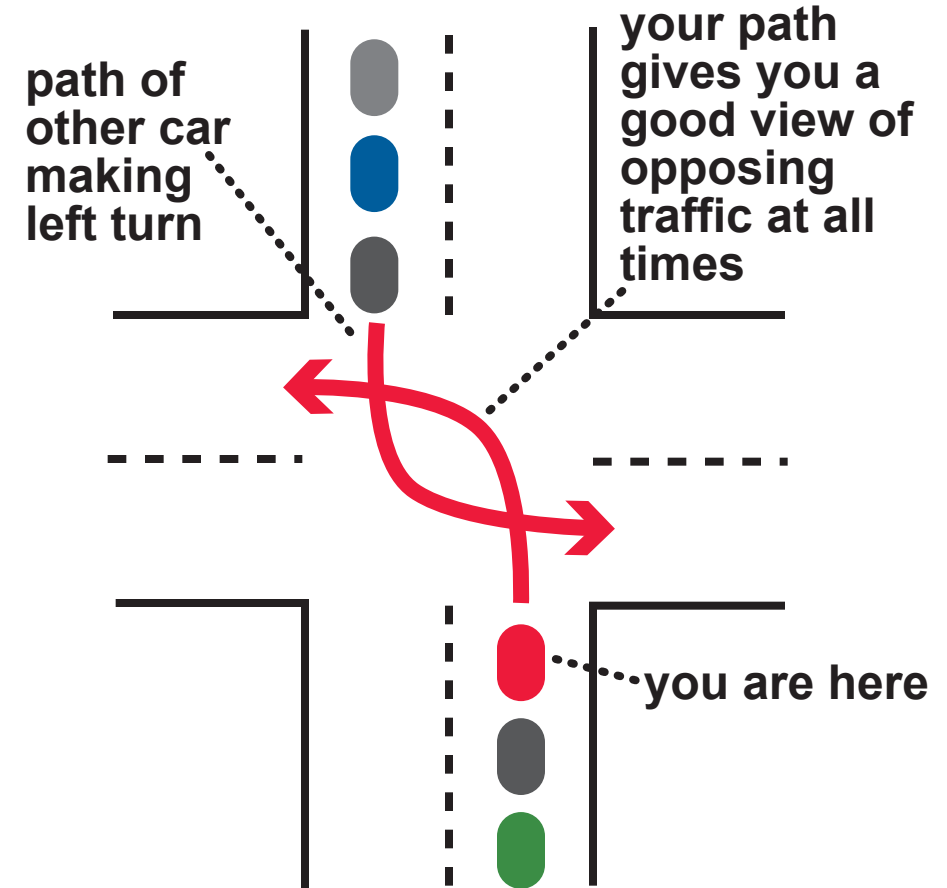
WHY THE WORD "MULTIPARADIGM" IS BAD

"Multi paradigm" is a chimera.

Latin origin

Greek origin

an imaginary monster compounded of incongruous parts

Start using "polyparadigm".

HOW TO MAKE A LEFT TURN, WHILE DRIVING IN NORTH AMERICA

path of other car making left turn

your path gives you a good view of opposing traffic at all times

you are here

(despite his many efforts to persuade us, no one at AT&T Research has ever had the courage to attempt this)

TELECOMMUNICATION SERVICES . . .

. . . ARE CONCEIVED AND BUILT IN
TERMS OF FEATURES SUCH AS:

Do Not Disturb
Voice Mail
Find Me

Speed Dialing
Outgoing Call Blocking
Voice Dialing

Call Waiting
Transfer
Conference

FEATURE CHURN

- features are being added and changed continually

- are optional for each subscriber

- can often be enabled/disabled dynamically by their subscribers

FEATURES INTERACT WHEN ONE
FEATURE MODIFIES OR INFLUENCES
ANOTHER
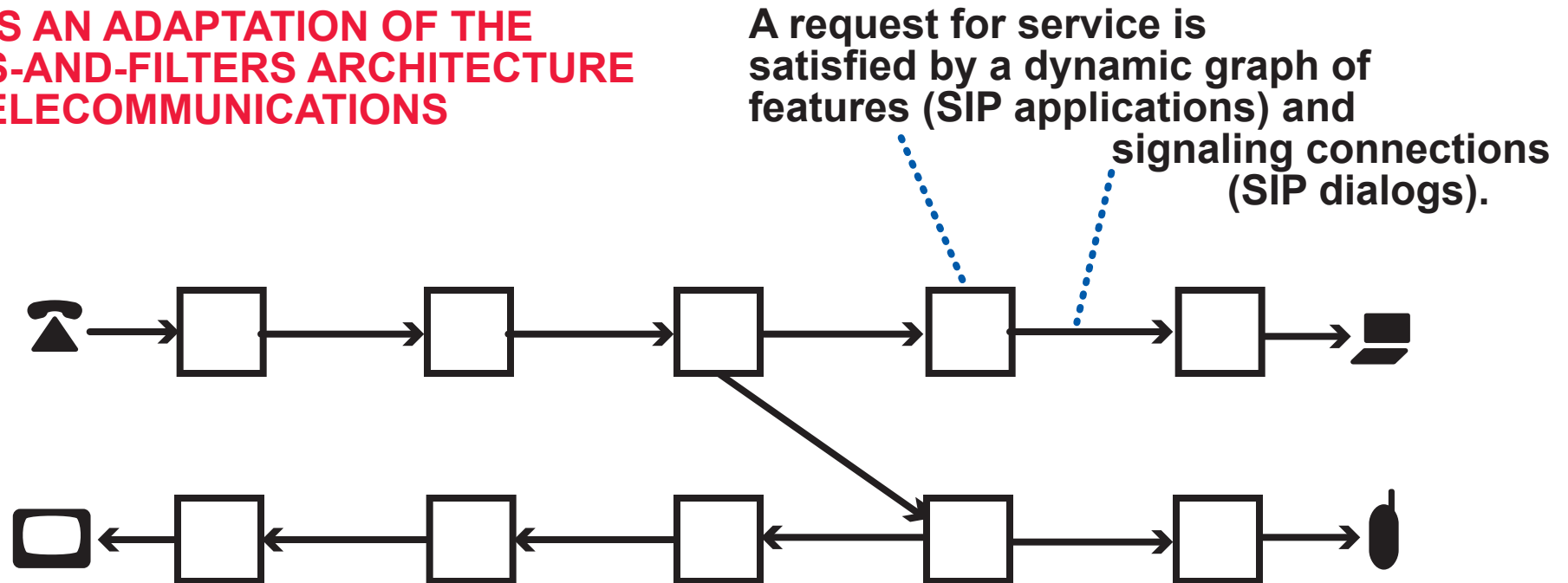
FEATURE INTERACTIONS ARE VERY COMMON

- all features are modifying or enhancing the same basic service, which is real-time communication among people

- the number of interactions is combinatorial in the number of features

FEATURE CHURN AND FEATURE
INTERACTIONS HAVE CAUSED
SEVERE SOFTWARE PROBLEMS IN
THE CIRCUIT-SWITCHED TELEPHONE
NETWORK

(ever since it became software-controlled in the 1960s)

MODULARITY AND COMPOSITION BASED ON THE
DISTRIBUTED FEATURE COMPOSITION ARCHITECTURE

DFC IS AN ADAPTATION OF THE PIPES-AND-FILTERS ARCHITECTURE TO TELECOMMUNICATIONS

A request for service is satisfied by a dynamic graph of features (SIP applications) and signaling connections (SIP dialogs).

MODULARITY

- a feature does not know about or depend on other features

- a feature can be added or deleted without changing others

MANAGEMENT OF FEATURE INTERACTIONS

- the architecture constrains how features can interact

- it is possible to predict potential interactions, enable the good ones, and prevent the bad ones

AT&T CALLVANTAGE^{SM} SERVICE

. . . is a consumer, broadband, voice-over-IP service.
Its advanced features were built with DFC.

FEATURE DEVELOPMENT

- a group of researchers delivered eleven complex features . . .

  e.g., Mid-Call Move
  Ten-Way Calling
  Parallel Find Me

  . . . two months from the inception of the project

  this is unprecedented speed

- all the feature interactions were successfully analyzed and managed during the same two months

SYSTEM INTEGRATION

- many integration problems with vendor-supplied components (IP routers, gateways, phone adaptors, media servers)

- DFC modularity was extremely useful for adding adaptors to patch over integration problems

  don't want to embed these in the service

DEPLOYMENT AND EVOLUTION

- supported many thousands of customers world-wide (without two media-intensive features)

- easy feature evolution

- the service won two industry awards, citing voice quality and advanced features

T-MEETING

**. . . is a teleconferencing system for internal use at AT&T.
It was built entirely with DFC.**

PHASE ONE (2006)

- **has mid-conference control from both phone and Web, recording, active speaker identification, user switching between multiple conferences**

- **during development, modularity supported functional prototyping, code reuse, deferred design decisions**

- **as with CallVantage, there were very few bugs in the application code**

- **supports millions of user minutes on a typical workday**

PHASE TWO (ongoing)

- **a re-implementation with our new standards-based software tools**