

**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

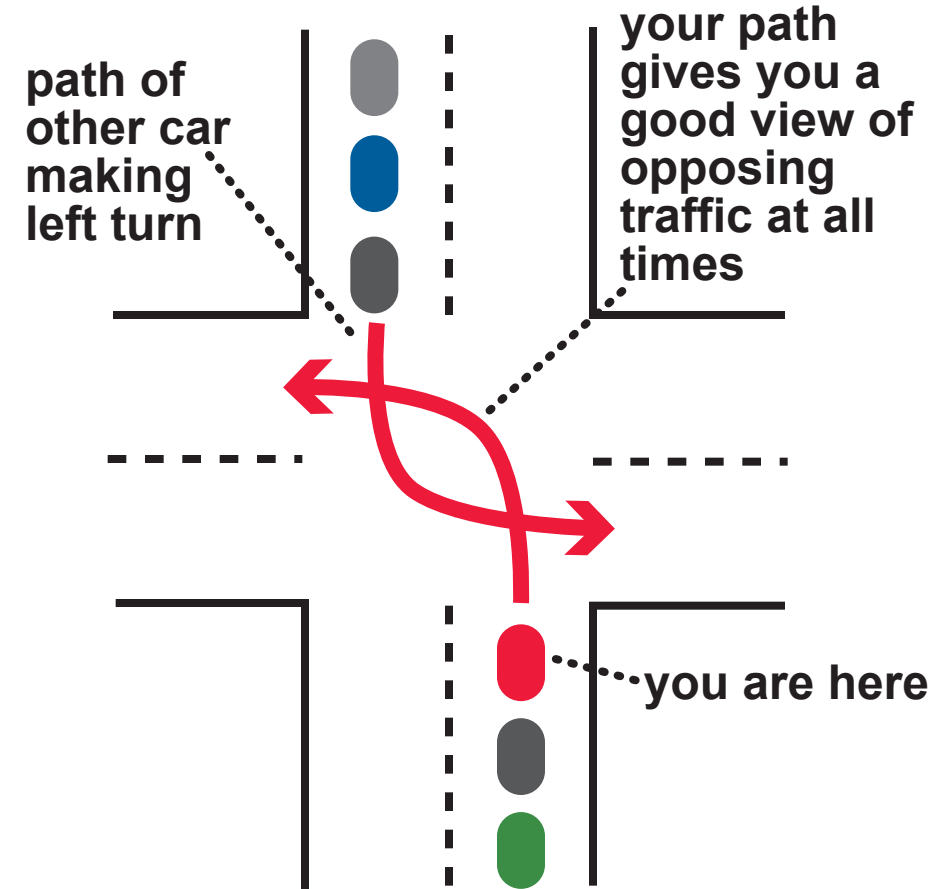
"Multi paradigm" is a chimera.

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



(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:

Speed Dialing
Outgoing Call Blocking
Voice Dialing

Do Not Disturb
Voice Mail
Find Me

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

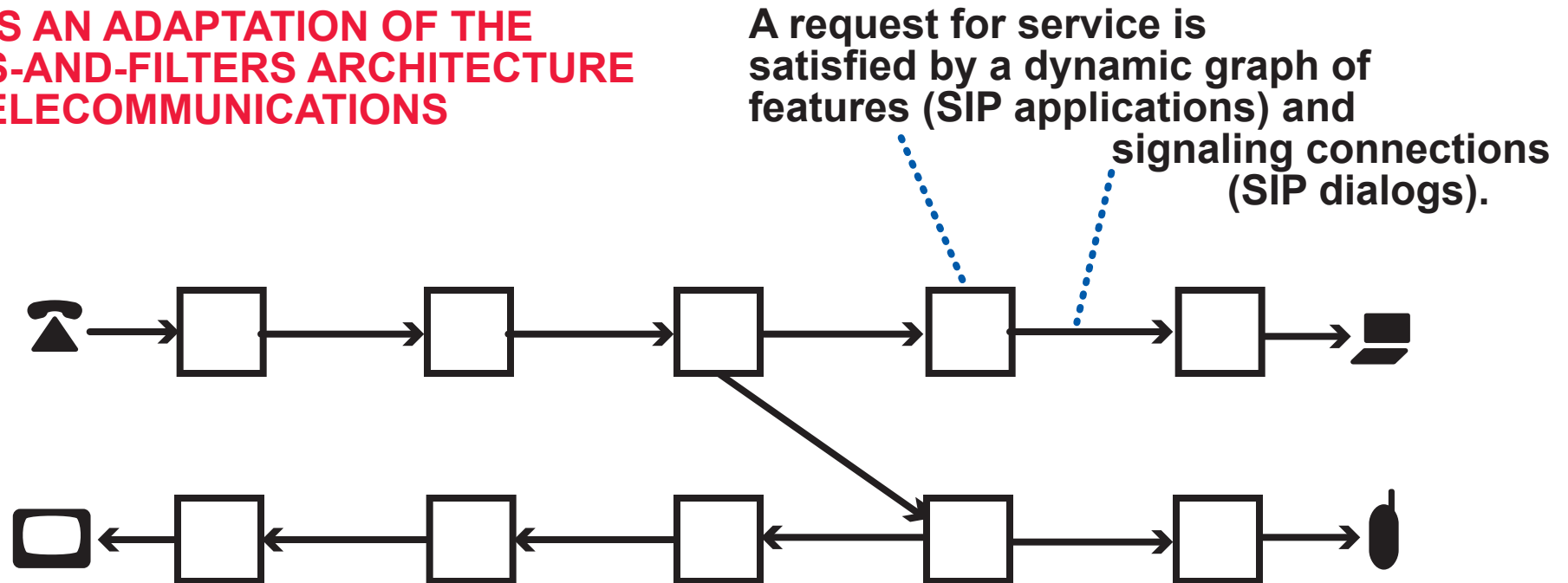
- all features are modifying or enhancing the same basic service, which is real-time communication among people
- the number of interactions is combinatorial in the number of features

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



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

... 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

